American Machinist

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

AUGUST 13, 1956

How to Cut Off Metal Stock
— A SPECIAL REPORT

Statistical Methods Cut Test Costs

Heald VERSATILITY in action

How a STANDARD* Plain Internal Grinder SAVED IDLE MACHINE TIME

Heald Model 271 does a month's production ALL IN A DAY'S WORK . . . and can do many other jobs in its "spare time"

THE race is not always to the swift. For example: An aircraft manufacturer requested a quotation on a Model 271 Size-Matic for grinding three double bores in a bearing housing. Production requirements — 25 parts per month. A high-speed Size-Matic would do the whole job in less than a day — and be idle the rest of the time. So Heald engineers recommended a Model 271 Plain Internal instead. This *semi-automatic* machine could still do the whole month's production in one day — yet because of its inherent *versatility*, the standard Plain machine could be used for many other internal grinding jobs in its "spare time".

This solution to the problem not only saved on the initial investment, but avoided idle machine time and contributed to greater productivity and lower costs. The 271 Plain Internal, and the job for which it was ordered, are shown below. For the *best answer* to any precision finishing problem . . .

It PAYS to come to Heald

*Send for Bulletin 2-2569-I, Issue I.

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THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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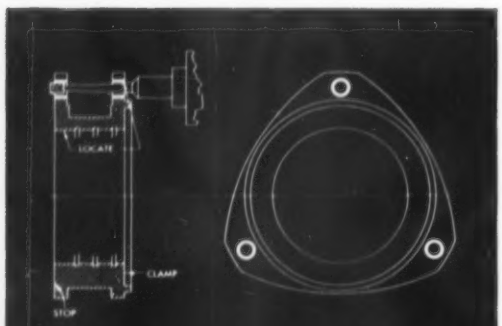
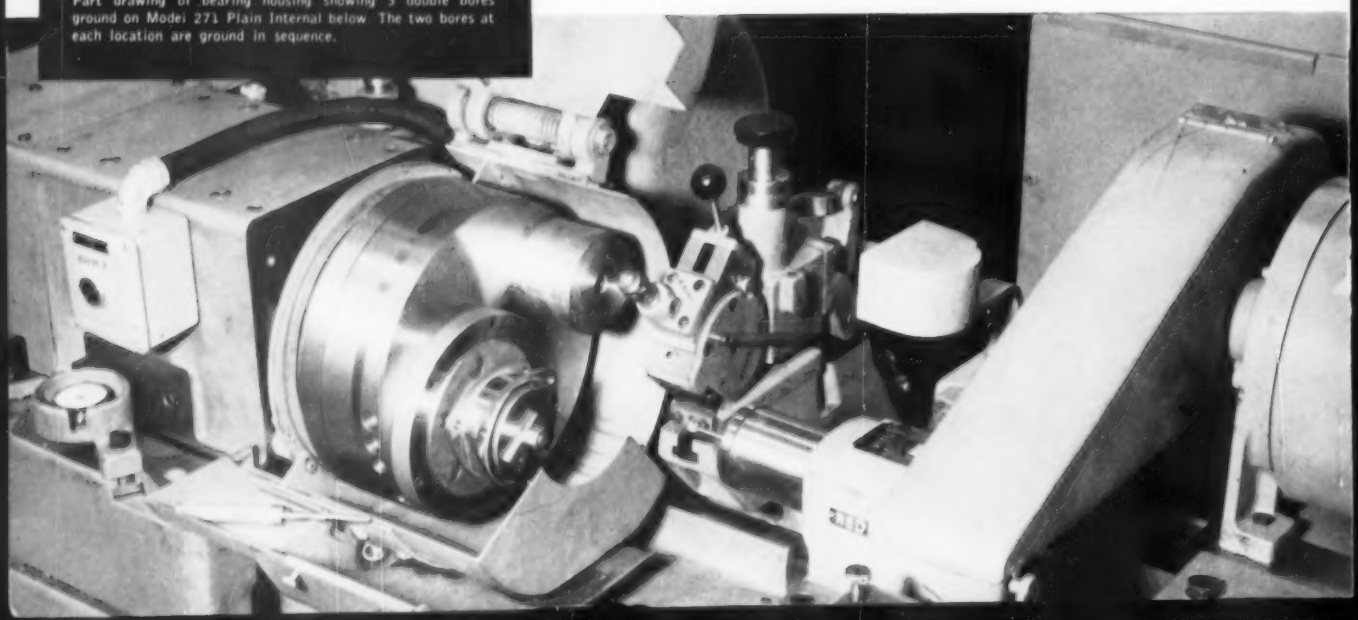


Part drawing of bearing housing showing 3 double bores ground on Model 271 Plain Internal below. The two bores at each location are ground in sequence.



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SPECIAL REPORT NUMBER 428

How to cut off metals . . . Because cutoff is so common, it should not be taken for granted. This review of fundamentals, including late developments, will help you review your operations to see where you can adapt, change, or simplify to improve efficiency and profit. *By Charles Emerson.* **133**

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Gear Tooling I, II, III . . . Selection of tools for spur and helical gears in the 4 to 20 diametral-pitch range to gain lower cost and higher accuracy. *By Glenn Tinkle, Illinois Tool Works.* **159**

American Machinist *Chips*

Cover . . .
Assembly of electronic instruments on printed-circuit panels at Hewlett-Packard is shown in a painting by Jo Willrodt. Five pages of practical ideas from this plant start on page 152.

Midsummer headache . . . The average production man, we find, may love his hobbies, but they have a way of taking second place to his interest in keeping the shop going on schedule. So you'll be able to understand how the varied interests of our editors (fishing and sailing, for two) can be pushed around when we see a last-minute chance to make a good issue better. Thus an issue comfortably on its way to closing may suddenly be torn apart and redone because a story we have long been after breaks—or one turns up without warning.

Two cases in point, not an unusual number, are in this issue. When Andy Ashburn first saw a copy (he won't say where) of the Taylor report to the Air Force on the impact of superalloys on machine tools, he found it so full of meaty ideas that prompt publication seemed essential. Some fast telephone calls and a quick draft of the story drew clearance from the Air Research & Development Command in record time. We had a new lead article, and you can see why all the excitement when you read "Will superalloys set output back 25 years?" starting on page 117.

No time for a deep breath after that before Bill Stocker walked in with a research report from Watervliet on carbide gun drilling. Bill has been following gun drilling for years and knows a good thing when he sees it. "I've been after this a long time," he said. "We've got to use it at once." A quick review, and we agreed. So the issue was revised again and Bill spend his weekend editing the report into the article on page 120.

Among the hazards this creates are in the work of the art department. When we pull an article out, it invariably turns out to be one which Dick Rooman or Ann Palmer have just finished the artwork. They have to put it aside and start on something new, often more complicated, and always in a rush. Next time we go back there, we'll probably step in the bear trap Dick was designing last night. Another hazard is that many of these changes take place after we've gone to press with the contents or with this page. That explains, for instance, why Burnham Finney's exclusive interview with the Soviet Minister of Machine Tools, Kostousov, which was so widely reported in the newspapers when we published it a couple of issues back, went unnoticed on this page. We didn't know about it yet when we wrote this column. And that is also why it is a little like looking in a crystal ball when we write the next paragraph.

Coming . . . *AM* for Aug 27 will feature a Special Report on new tooling and techniques for working wire. Decribing how Western Electric makes wire-spring relays for telephone switching systems, it includes wire straightening, progressive dies, welding on contacts, and assembly in plastic bodies. There will be articles on plastic tooling, nylon parts, wheel welding, cutting non-linear pitch screws, and a searching analysis of the responsibilities of management. Well, maybe it will contain those features. One thing we know for sure: the cover will show the first published picture of an unusual machine tool that is permanently hung from a crane.

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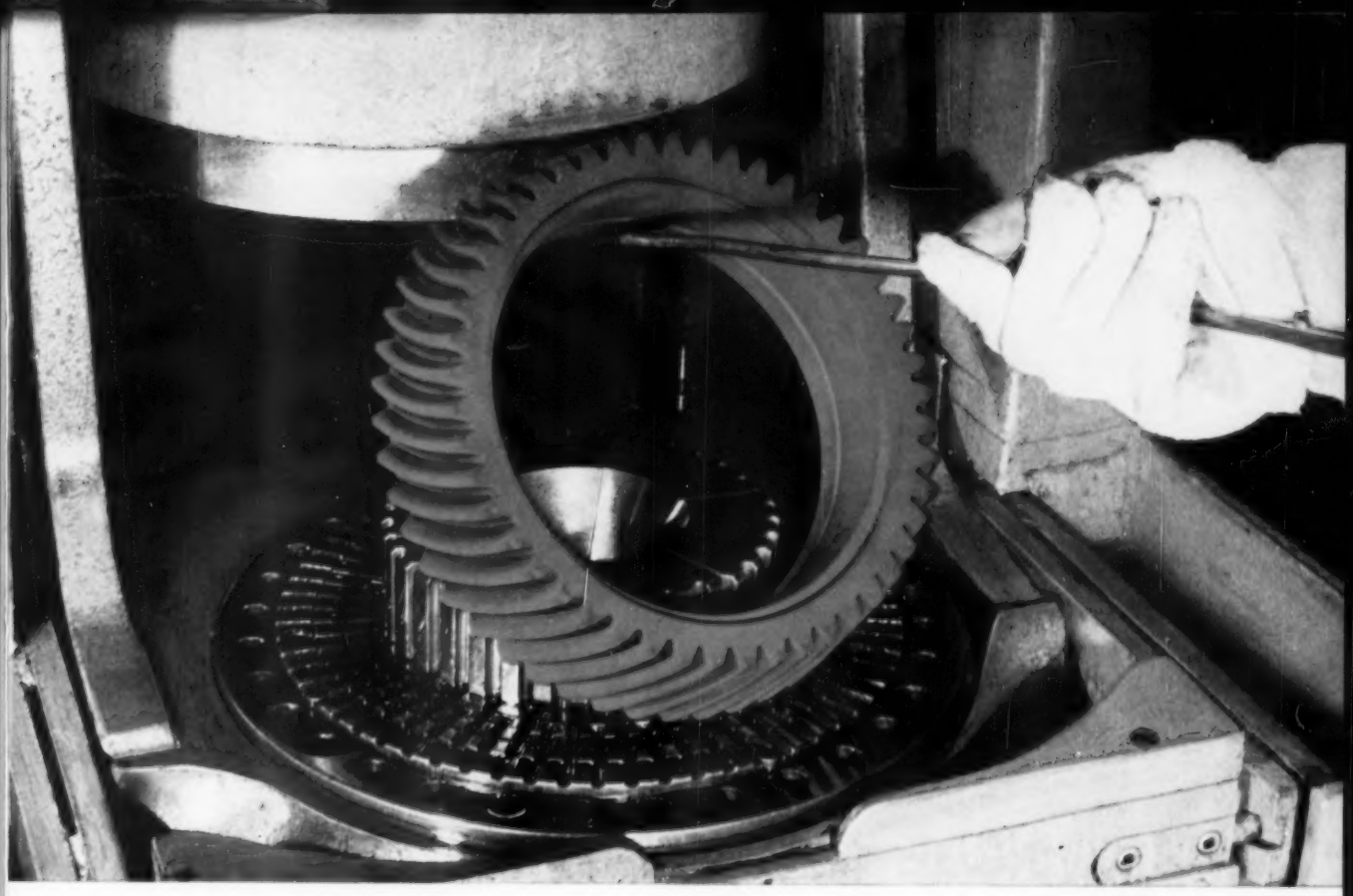


How to hold close tolerances when you quench gears and other parts

If you make parts like this aircraft transmission gear, you know that warpage or distortion during quenching means losing the time and money you've spent machining the part to close dimensional tolerances.

You can avoid such costly losses with Gleason Quenching Equipment.

The hot gear above, for example, is being set on the lower die of a Gleason Quenching Press. A button is pressed and the automatic quenching cycle is started. The lower die is swung back into the quenching position and the upper die descends rapidly, aligning the part while it is still in the plastic state.

The dies securely clamp the gear, but are so designed to permit it to contract in the normal manner, while still holding the gear true.

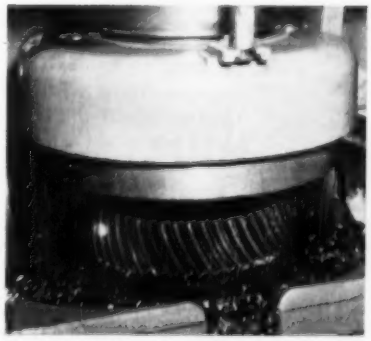
Carefully controlled metallurgically correct oil circulation hardens the gear to perfection.

Post-quench tests show the gear meets all specifications.

You can give *any* part, regardless of shape, the same distortion-free quenching.

Three sizes of the Gleason Quenching Press harden parts up to 36" diameter. Another press automatically hardens and straightens shafts and shaft parts up to 40" in length.

For literature and recommendations on the press and die equipment that fit your products, send us blueprints.



The Gleason Quenching Press forces oil uniformly over and around the part, assuring the correct hardness and distortion-free quenching.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

They'll Never Quit When You're

The mathematics of maintenance is rather simple. Just eliminate one hour of down time and you'll save many dollars in production. Cincinnati Milling engineers are thoroughly familiar with these simple facts of machine tool performance and have incorporated a number of features in the ML and MI lines to give them the highest degree of reliability. A few of the many advantages are illustrated here. All of them help to stretch the machine's high-quality, reliable performance over many years. And to match this performance, CINCINNATI® ML and MI Milling Machines are equipped to handle a wide variety of operations:

- 16 feeds, ¼" to 30" per min. Higher range optional
- 16 spindle speeds, 25 to 1500 rpm. Lower and higher ranges optional
- Single crank selection of spindle speeds with hydraulic gear shift
- Single crank selection of feeds
- Independent, directional controls
- Live rapid traverse
- Available in the styles desired by your shop
- Attachments to suit your needs

CINCINNATI ML and MI Milling Machines are unquestionably your best buy for medium duty variety milling or both variety and production milling. Want more information? Look in Sweet's Machine Tool Catalog, or write for a copy of catalog No. M-1916.

THE CINCINNATI MILLING MACHINE CO.
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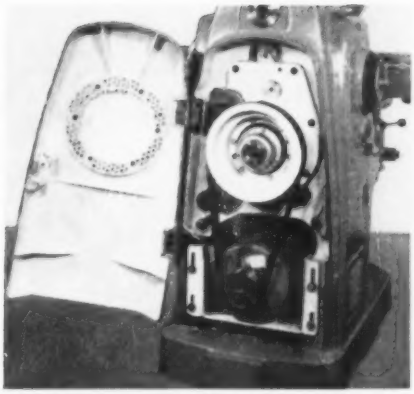
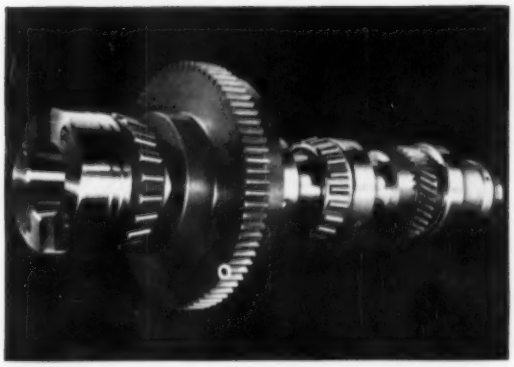
MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES

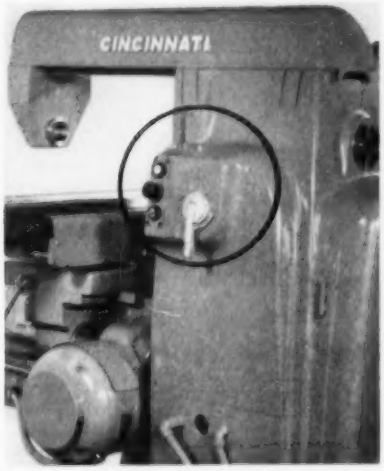


Spindle drive motor is readily accessible from the rear of the machine.



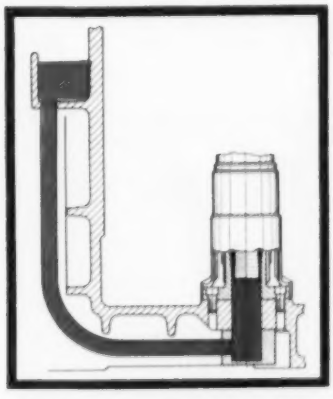
Spindle is ruggedly constructed for maximum hp cuts.

Busy



Built-in electrical controls assure two-way safety—for the operator and the equipment.

Oil shot and automatic lubrication cuts service attention to a minimum.



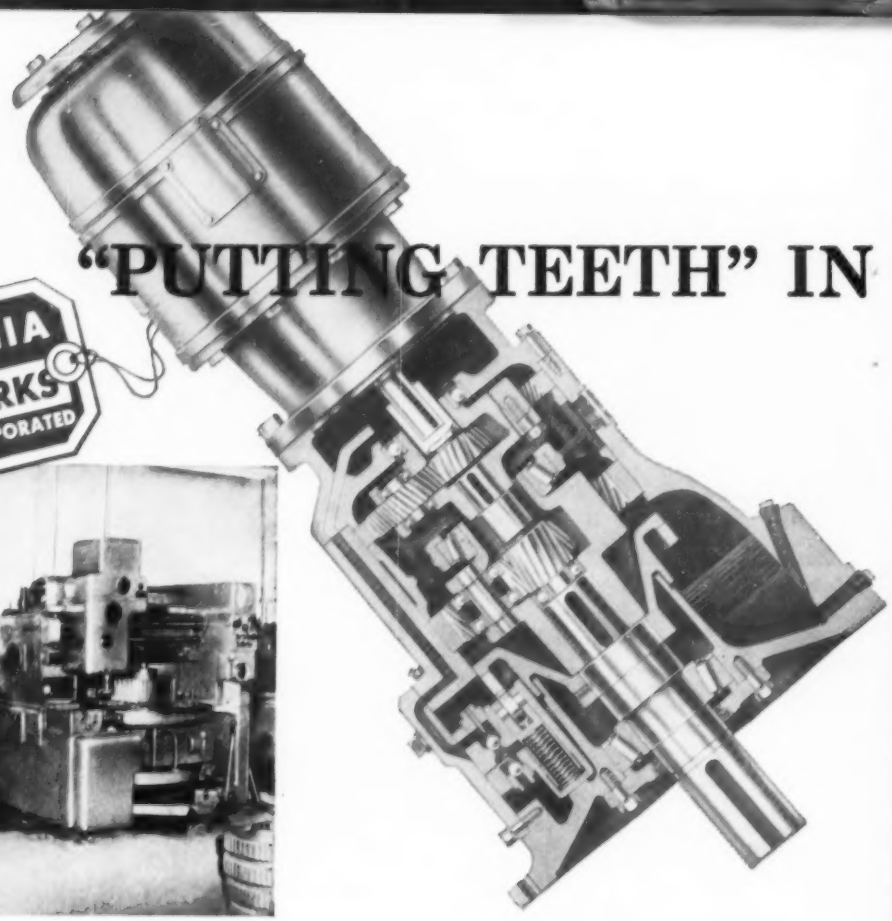
Vertical screw is submerged in a bath of oil at all times—for long, accurate life.

HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

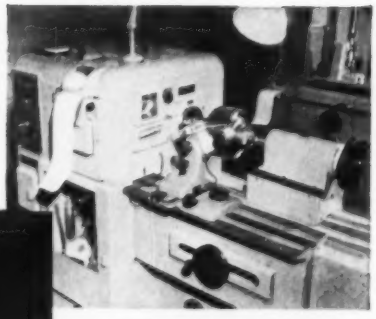
"PUTTING TEETH" IN

PHILADELPHIA GEAR WORKS INCORPORATED

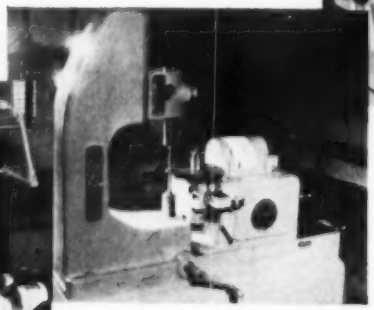
Fellows 36-Type Gear Shapers at Philadelphia Gear Works: powerful, accurate and fast on long runs or special jobs.



CUTTING / INSPECTION



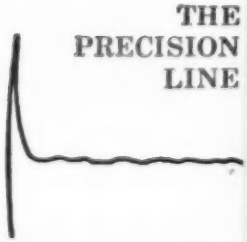
Fellows No. 12H Lead Measuring Instrument checks lead, crown and taper and electronically provides charts of results for Philadelphia Gear.



Fellows No. 20M Red Liner automatically records all gear errors in combination, giving Philadelphia Gear a composite check on quality.

Fellows No. 12M Involute Measuring Instrument at Philadelphia Gear is simple to set up, checks involute profiles, and records any departure from specifications.

THE PRECISION LINE



phillie gear® STANDARDS

Integrated Fellows Gear Shapers and Inspection Instruments Assure Close-Tolerance Production

Consistently high quality is maintained at Philadelphia Gear Works by fast and accurate Fellows Gear Shapers teamed with Fellows Inspection Instruments. Inspection and recording by Fellows Instruments gives accurate warning of production errors and their nature, provides visible proof of gear quality. 'Phillie Gear' relies on Fellows equipment for producing gears for their famous Speed Reducers as well as many other industrial spur or helical gears.

Integrated production and inspection with Fellows equipment assures unified responsibility for meeting standards and precise quality control at lowest possible costs.

Ask any Fellows Representative for full information about the complete line of Fellows Gear Shapers, Shaving Machines, and Gear Inspection Instruments.

THE FELLOWS GEAR SHAPER COMPANY
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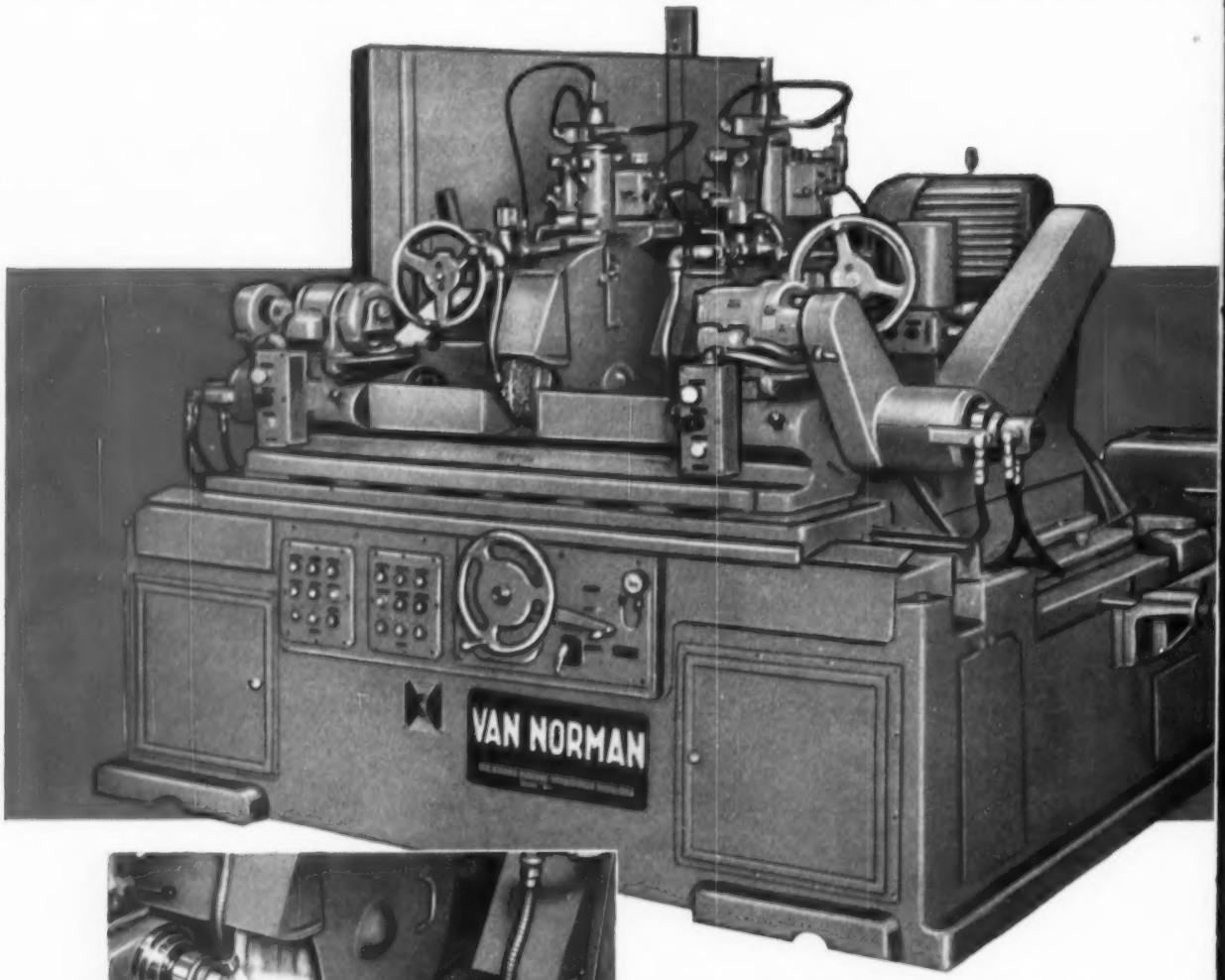
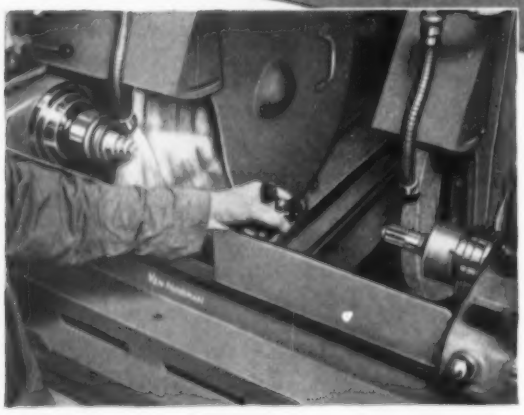
Fellows *Gear Production Equipment*

VAN NORMAN



Van Norman "Bowgage" 4BG2 double head plunge cut chucking grinder. Capacity: 6" swing double work head. Grinding wheel: 30" x (¾ to 6) x (12 or 20). Grinding wheel motor: 10 to 20 H.P.



Grinding Universal joint flange on the Van Norman "Bowgage" 4BG2 — .022 stock removal — 1.625 diam. — 15 R.M.S. — Maximum 480 pieces per hour.

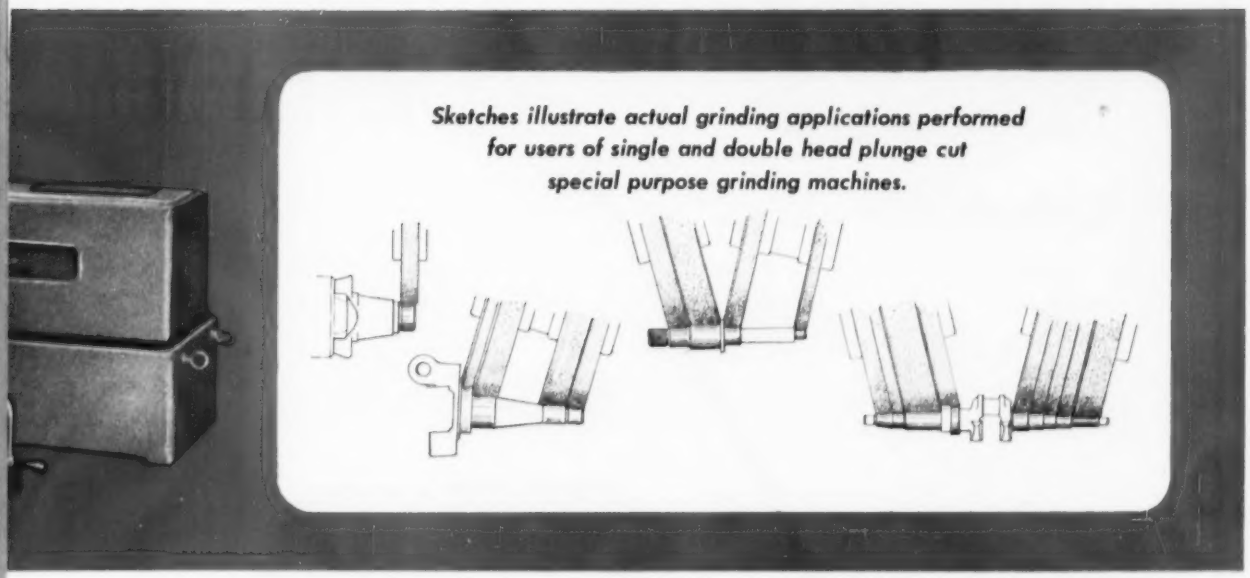
VAN NORMAN MACHINE

MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

"BOWGAGE" PRODUCTION GRINDERS

"Engineered for the Job"

Outperform Them All For Speed, Accuracy and Low Cost Grinding



Sketches illustrate actual grinding applications performed for users of single and double head plunge cut special purpose grinding machines.

You just can't beat Van Norman "Bowgage" Production Grinders for fast, economical mass production. These massive, rugged grinders are "*engineered for the job*" to meet your exacting requirements.

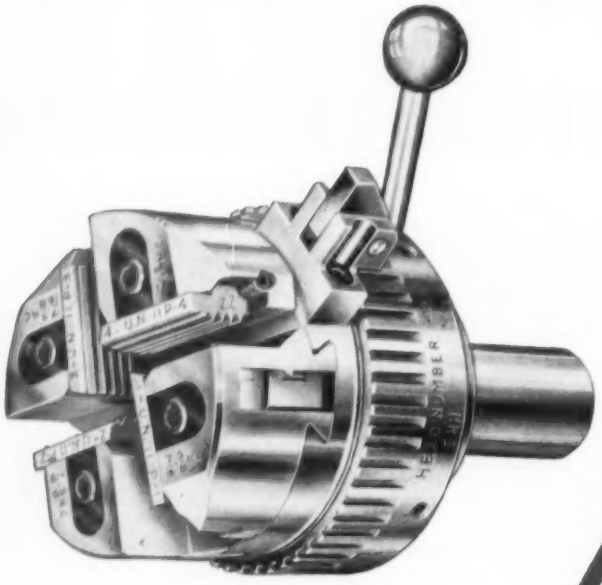
Illustrated is the Van Norman "Bowgage" 4BG2 double head plunge cut grinder designed and built for a major automotive manufacturer. Day after day, this 14.8 ton rugged brute and other single and double head grinders are showing substantial savings by keeping production up and costs down.

If you have a mass production grinding problem, let Van Norman Engineers help you solve it. Write for their help, today.

**Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company. Lease and Conditional Sales Contracts not available to Export.*

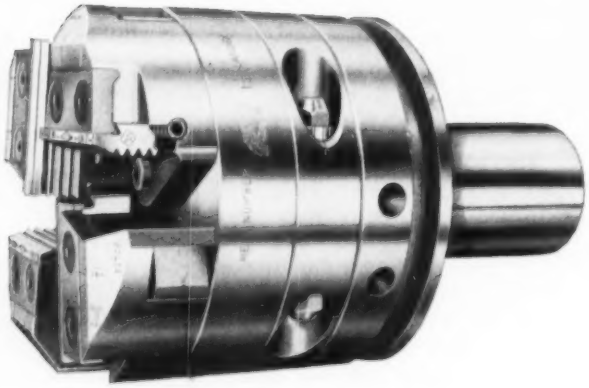
COMPANY

SPRINGFIELD 7, MASSACHUSETTS



for Class 4 and 7 tolerances
HARDENED-AND-GROUND Die Heads

2 ..... maximum



for Class 2 and 3 tolerances
HEAT-TREATED Die Heads

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.

448-C

styles of LANDIS Die Heads
PRECISION or ECONOMY

"Threading Efficiency" requires the selection of the proper die head for the job to be done, and is the essence of LANDIS design. To ensure that you may use the most efficient threading tool, LANDIS manufactures Die Heads in two basic styles:

HARDENED-AND-GROUND HEADS should be used where a high degree of thread-cutting accuracy is required. Their fundamental design and the inherent qualities of specially selected and hardened materials provide the maximum rigidity necessary for threading to Class 4 and Class 7 tolerances.

HEAT-TREATED HEADS are designed for the utmost economy when doing commercial threading, and will produce threads to Class 2 and 3 fits. The initial cost is small and rugged construction ensures trouble-free operation and few repairs. Wide range coverage requires minimum tool inventories, and along with the use of LANDIS Tangential Chasers allows maximum output per dollar of tool cost.

LANDIS Tangential Chasers are an important factor both in the economy and precision of these basic head styles. These chasers may be replaced or reground singly, will thread all diameters of the same pitch and form, and can be used for 80% of their original length. Their basic design minimizes stress and distortion, and allows either style of die head to produce threads of the accuracy for which it is recommended.

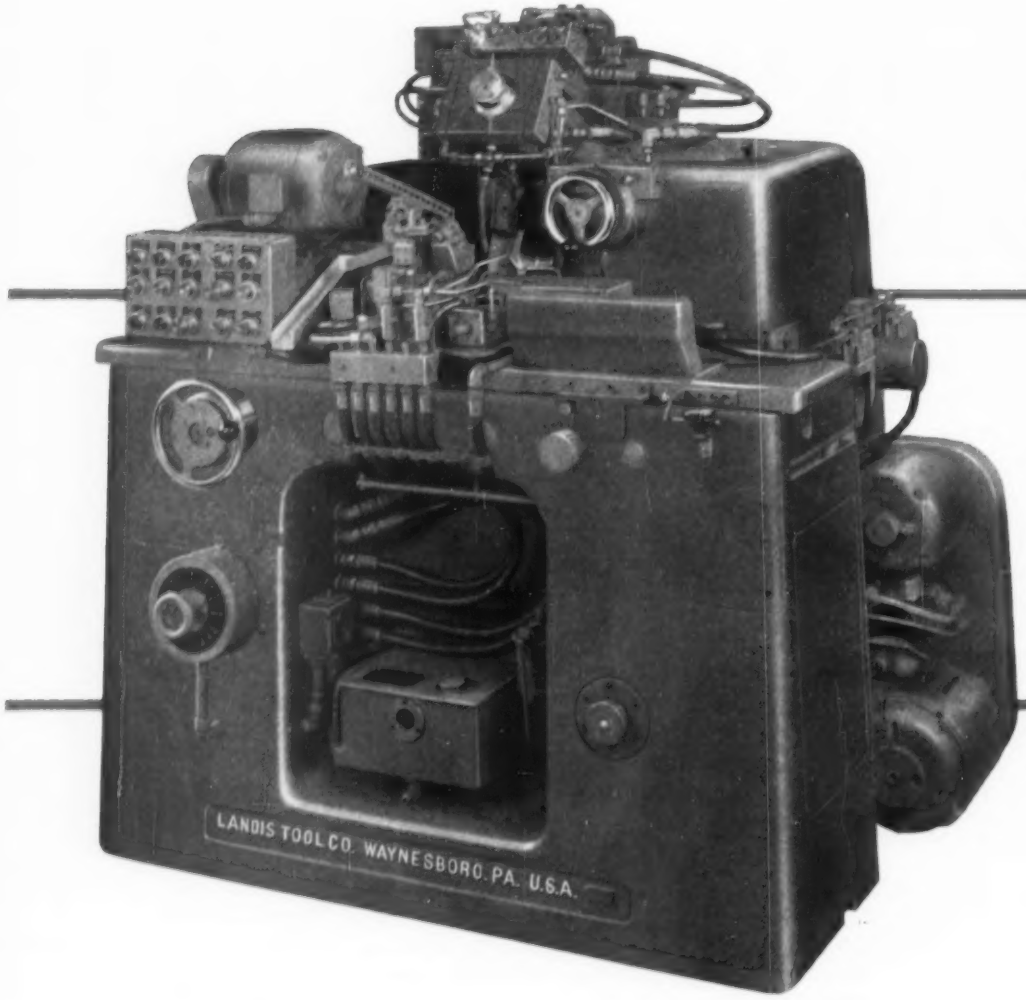
LANDIS manufactures more than 100 sizes and styles of standard and special Die Heads for use on threading machines, turret lathes, tapping machines and bar automatics. Let us suggest the Head most suitable for *your* needs—send specifications and ask for Bulletins F-80 and F-90.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

648-C

Change automatic grinder

...grinding small parts by the shoe-type



Landis 4'' Automatic Concentric Grinder
arranged for grinding grooves in inner races

LANDIS

precision grinders

setup in less than one hour!

centerless method on Landis 4" concentric

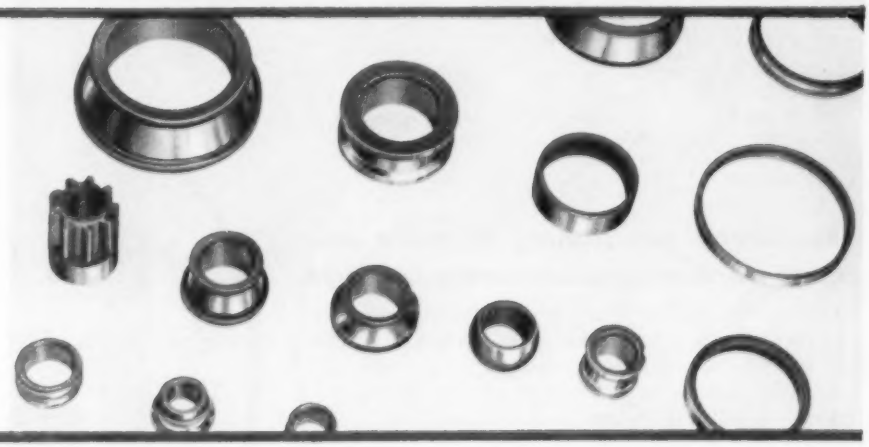
shoes locate on I.D.
work loaded automatically

change setup in
less than one hour

actual time recorded during a typical major setup change

1	Remove guard, magazine, guide cover and plate		31 Sec.
2	Remove work arbor and chuck	2 Min.	10 Sec.
3	Install new driving chuck (or driver)	2 Min.	15 Sec.
4	Install work setting gauge, adjust and remove	4 Min.	30 Sec.
5	Install guard, magazine, guide cover and plate	3 Min.	10 Sec.
6	Install lapping wheel, lap chuck and remove	15 Min.	
7	Locate carriage	3 Min.	
8	Set diamond for correct radius and dress	6 Min.	
9	Adjust cycle and headstock speed	4 Min.	
	TOTAL TIME ELAPSED	**40 Min.**	**36 Sec.**

parts like these ground
to super precision



LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

124 operations—

milling, drilling, boring, reaming, tapping, spot facing on column for transfer machine proves big *capacity* and *versatility* of G&L's Model 350-T Horizontal Bar

Choice of machine tool builders, too! National Automatic Tool Co. of Richmond, Indiana, gets *far more capacity* and accomplishes a far broader range of work on a single weldment with a Giddings & Lewis Model 350-T (table type) Horizontal Boring, Drilling and Milling machine. As illustrated, the Model 350-T completes a total of 124 operations—milling, drilling, boring, reaming, tapping and spot facing — to exact tolerances on all sides of a 3½-ton cast-steel column used for a special three-way boring machine.

This versatile Giddings & Lewis Horizontal gives the operator such helpful features as the exclusive "Lubri-Cool" system that assures machining accuracy under heavy loads and at ambient temperatures . . . an electrically-operated positioning device that provides maximum accuracy on various machining sequences . . . and an extended saddle, saddle support and auxiliary runway that permit machining at increased work ranges.

The 350-T is equipped with a 5-inch diameter spindle . . . 45 speeds, with 18 feeds in each speed range.

Giddings & Lewis offers you 30 Series Table Type Horizontals with four- or five-inch diameter spindles with a choice of 15 table sizes, and a host of attachments and accessories which *simplify jobs, increase capacity* and *lower production costs.*

For complete information on G&L 30 Series machines, see your nearest Giddings & Lewis sales representative. He'll be glad to tell you what these machines can do for you.

G&L HYPRO

G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN
6-60

For complete specifications on Giddings & Lewis 30 Series (table type) Horizontal Boring, Drilling and Milling machines, ask for Catalog 30-T.

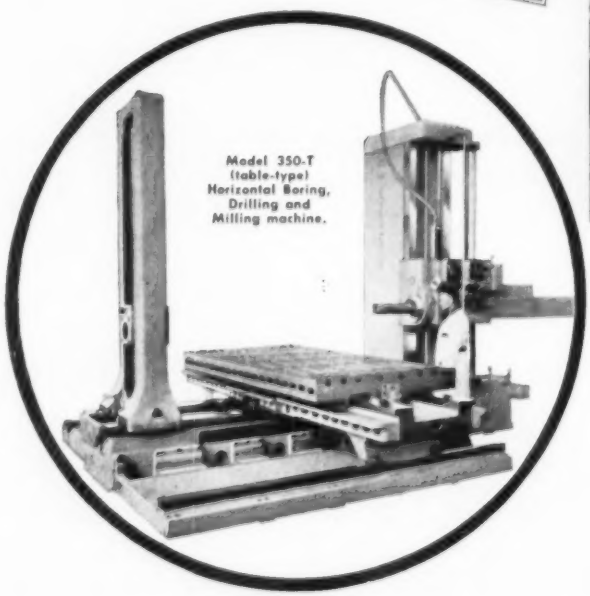
Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines—table, floor and planer types; HYPRO Double Housing and Open Side Planers, Planer Type Milling Machines and Vertical Boring Mills; Spar and Skin Milling Machines, and VARIAX machines.

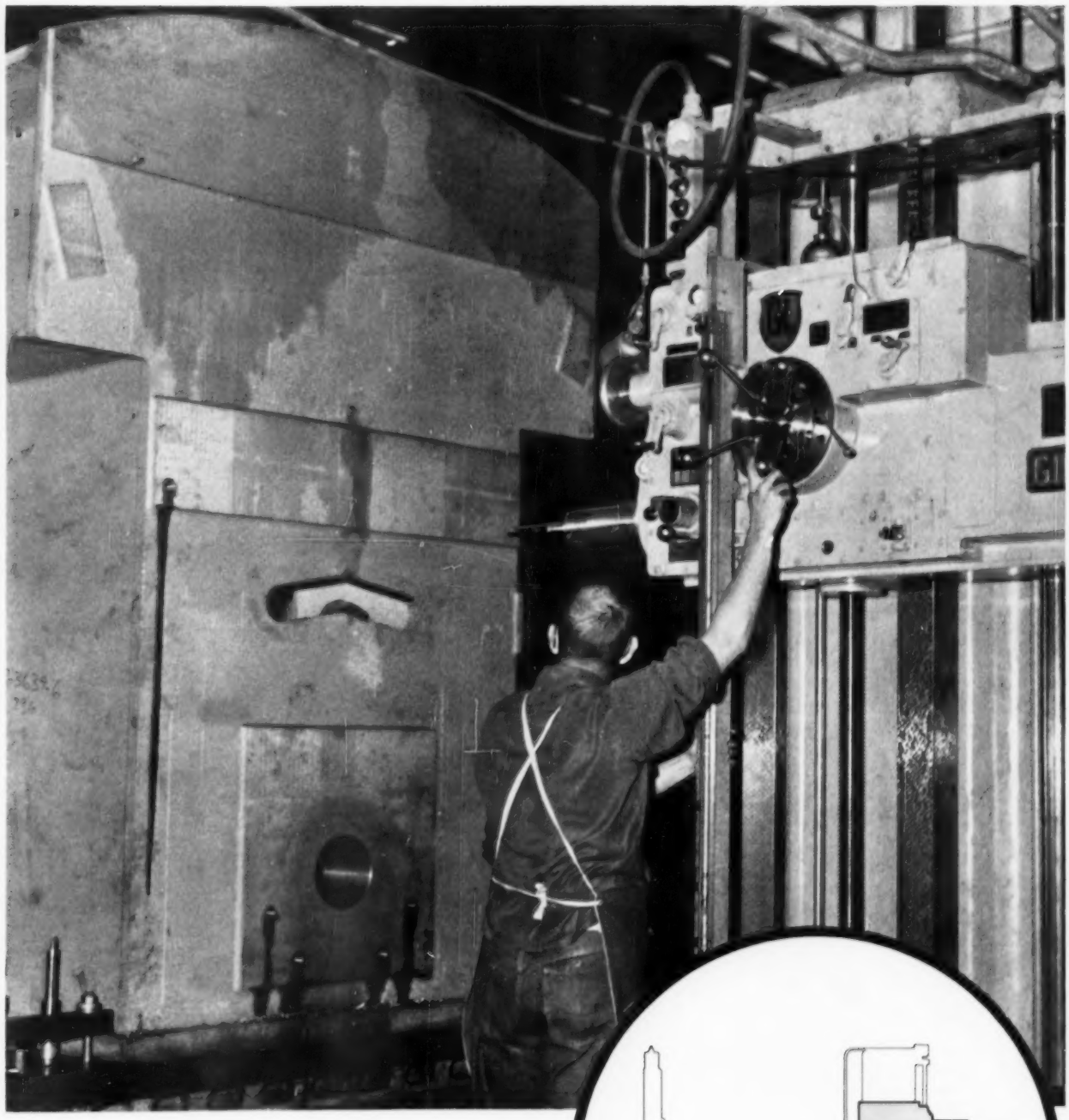
Automatic positioning of table and headstock assures accurate settings

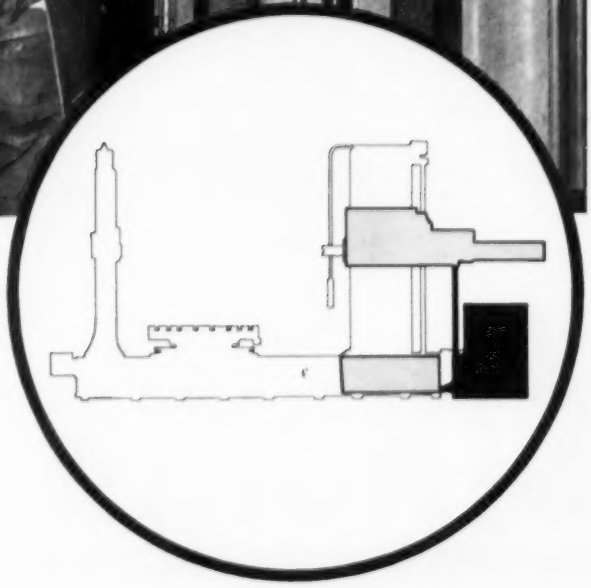
Another optional aid to accuracy and speed is the fast-acting Giddings & Lewis electrically-operated positioning device. This arrangement automatically moves and accurately positions machine table and headstock. It offers new ease in maintaining required work precision.

With it you can:

1. Predetermine table and headstock settings to extremely close limits (± .0002").
2. Eliminate time-consuming final hand adjustments in locating work for precision operations.
3. Reduce or practically eliminate the need for special jigs and fixtures.







Exclusive "Lubri-Cool" system assures accuracy under ambient temperatures

Another outstanding feature in Model 350-T is the exclusive Giddings & Lewis "Lubri-Cool" system which maintains production accuracy under *heavy loads* and in *hot weather*. The refrigerating lubricant cooling system, shown at right, is connected to the headstock and milling feed unit. It offers a simple means of maintaining accuracy under extreme ambient temperature conditions.

Why Do This

Remove Wheel Mount
Statically Balance
Replace Wheel Mount

Up to 90 Min.

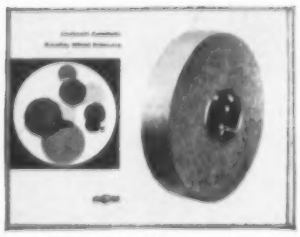
Have you ever seen an operator balance a grinding wheel mount on conventional static balancing ways? It's a tedious operation, and may require 90 minutes or more to remove wheel mount, balance and replace mount. Cincinnati did something about this. They developed automatic grinding wheel balancing that does the job ten times more accurately and infinitely quicker and easier.

This exclusive Cincinnati feature automatically balances the grinding wheel mount on the machine . . . within a few seconds . . . while the spindle rotates at its operating speed. **This exclusive Cincinnati feature** eliminates vibration and resultant chatter on the work . . . permits more effective stock removal . . . reduces wheel cost per workpiece.

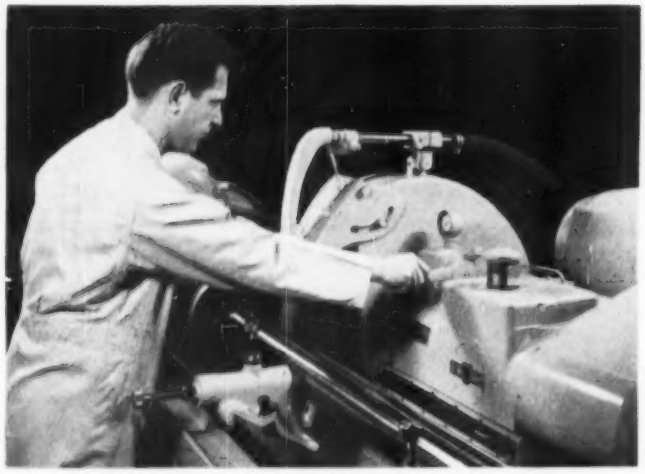
FILMATIC® spindle bearings and automatic grinding wheel balancing constitute a team that just can't be beat for lower cost precision cylindrical grinding. Best of all, these features are standard equipment on CINCINNATI® FILMATIC 6", 10"L, 10", 14"L, 14" and 18" Plain Grinders, and on 6", 10"L, 10" and 14"L Angular Feed Plunge Grinding Machines. Write today for the complete balancing story. Ask for publication No. G-637-1.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

FILMATIC



Publication G-637-1 explains the Cincinnati Automatic Balancing principle. Write for a copy.



In the illustration above the operator shows how easy it is to balance the grinding wheel on a CINCINNATI FILMATIC 10" x 72" Plain Hydraulic Grinder.

CINCINNATI

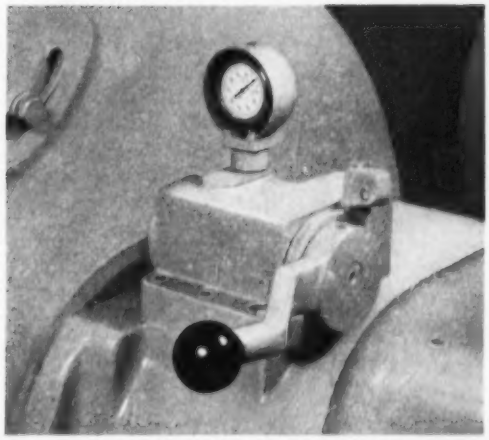
CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES

When You Can Do This

Automatically Balance on Machine

Less Than 30 Sec.

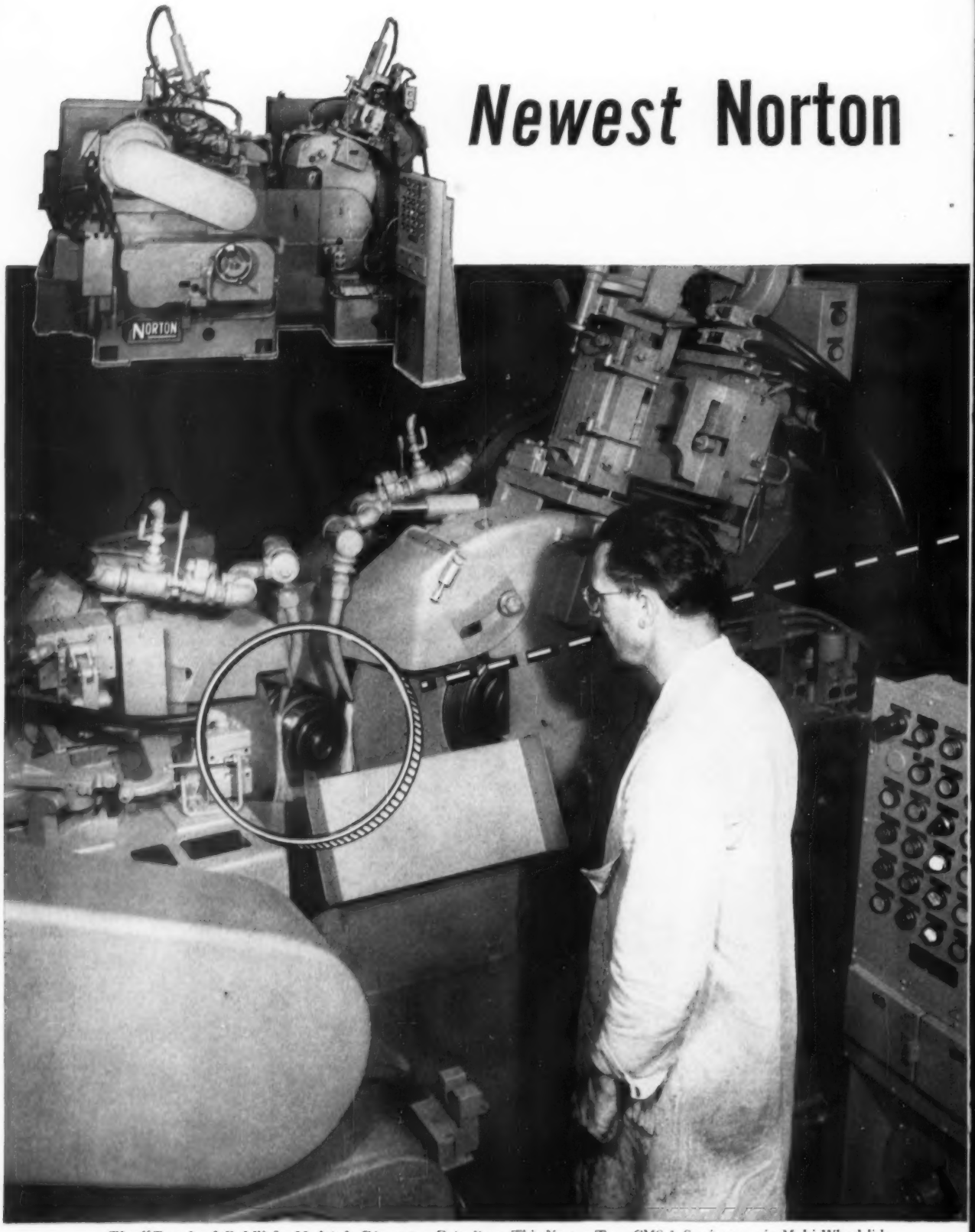


Automatic balancing control lever and indicator.

Grinding Wheel Balancing and FILMATIC Grinding Wheel Spindle Bearings are standard equipment. These two cost-reducing features alone are reason enough to choose Cincinnati.

CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

Newest Norton



The "Touch of Gold" In Multiple Diameter Grinding. This Norton Type CMS-1 Semiautomatic Multi-Wheelslide Cylindrical Grinder is set up to grind two conical surfaces simultaneously in automatically controlled plunge grinds. The wheelslides, opposed here, may be positioned in-line if the job requires.

grinder for multiple diameters

The Type CMS-1 Semiautomatic Multi-Wheelslide Grinder handles jobs impossible on ordinary multi-wheel machines

Here's a brand new Norton grinder with a special capacity for high production, low cost grinding of multiple diameter work.

The Type CMS-1 Semiautomatic Multi-Wheelslide Cylindrical Grinding Machine cuts production time and expense in a number of different ways. It grinds with top speed and accuracy. It reduces grinding wheel costs. Most importantly, it eliminates the need for separate grinds on separate machines.

Advanced Multi-Wheelslide Arrangement

During building, the Type CMS-1's sturdy, unitized wheelslides are positioned — opposed or in line — for specific job requirements. In use, slight angular or lateral adjustments may be made when setting-up. Each wheelslide mounts one or more 30" grinding wheels, with the type of work-holding equipment depending on the job. Slides operate in unison during production, but may be individually controlled for set up.

Other Outstanding Features

- Central, one-lever control of the automatic grinding cycle — plus automatic, electrically timed termination of the cycle — for greatly simplified operation.
- Two-rate automatic feed assures ideal conditions for rapid stock removal, with highest accuracy and finish.
- Convenient wheel feed hand wheels have "click-count" indexing, permitting feed adjustments in increments of "tenths." This simplifies size control in setting-up and in initial operation.
- Individual push-button-operated jogging control of wheelslides aid production by simplifying size control.
- Automatic wheel guard type truing devices operate consistently at predetermined speed and feed. Control of the amount of abrasive removed is close and uniform, with compensation of wheelslide setting for wheel diameter reduction. Results are most efficient, effortless truing, with reduced wheel cost per piece ground.

Get All The Facts

on the new Type CMS-1 grinder from your Norton Representative. Learn how you can improve your competitive position by replacing two or more old grinders with this ultra-modern machine. Or write direct to us for the whole story. And remember: only Norton offers you such long experience in both grinding machines and wheels to bring you the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

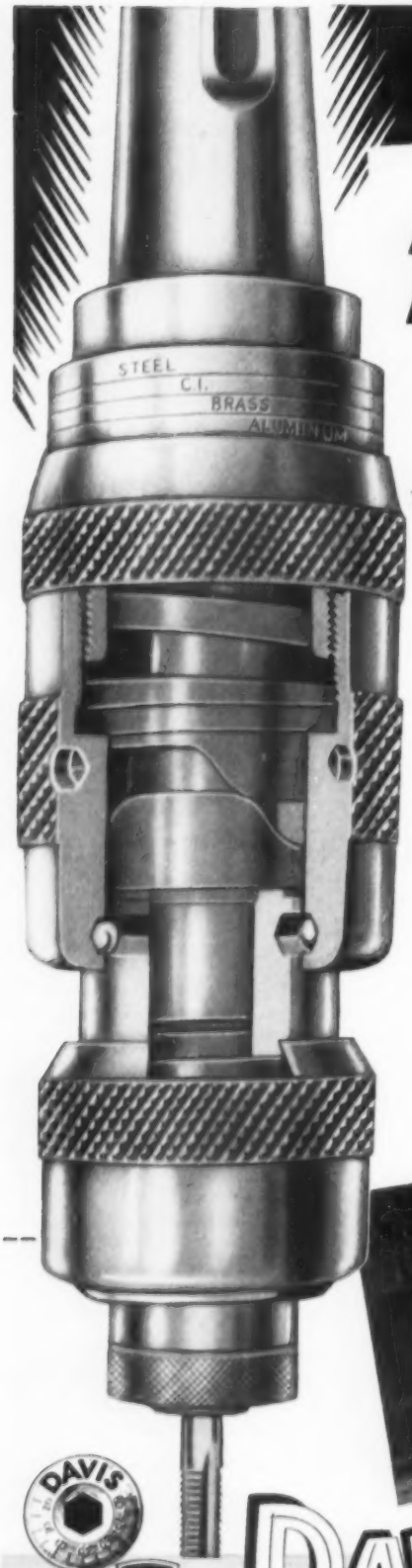
Making better products... to make your products better

District Sales Offices: WORCESTER • HARTFORD • NEW YORK • CLEVELAND • CHICAGO • DETROIT

★ MINIMIZE TAP BREAKAGE! ★ INCREASE TAP LIFE!
★ GET MORE ACCURATE, BETTER-FINISHED THREADS!

NEW DAVIS tap-saver

Automatic Torque Control TAPPING HEAD

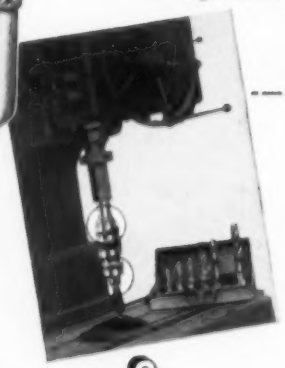


adjusts driving torque to suit material, type of tool and size of tap

Turn the material selector dial to the proper setting...insert the tool with its proper collet...and your TAP-SAVER tapping head automatically provides exactly the right driving torque for all working conditions!

What's more, this torque is always accurately maintained. Whenever resistance increases, controlled slippage in the overriding clutch within the tapping head compensates for it. Think what this means in terms of operating advantages! Tap breakage is virtually eliminated. Thread accuracy and finish are improved materially. And output rises profitably. Production time is also cut sharply as tools easily interchange in the TAP-SAVER'S quick-change chuck. A series of operations on the same hole can be completed without repositioning either spindle or the work—only the collet and tool are changed.

Investigate now—learn how the new Davis TAP-SAVER can solve many production problems for you and quickly pay for itself in decreased machining costs. WRITE FOR BULLETIN No. DB-160.



Machining Advantages

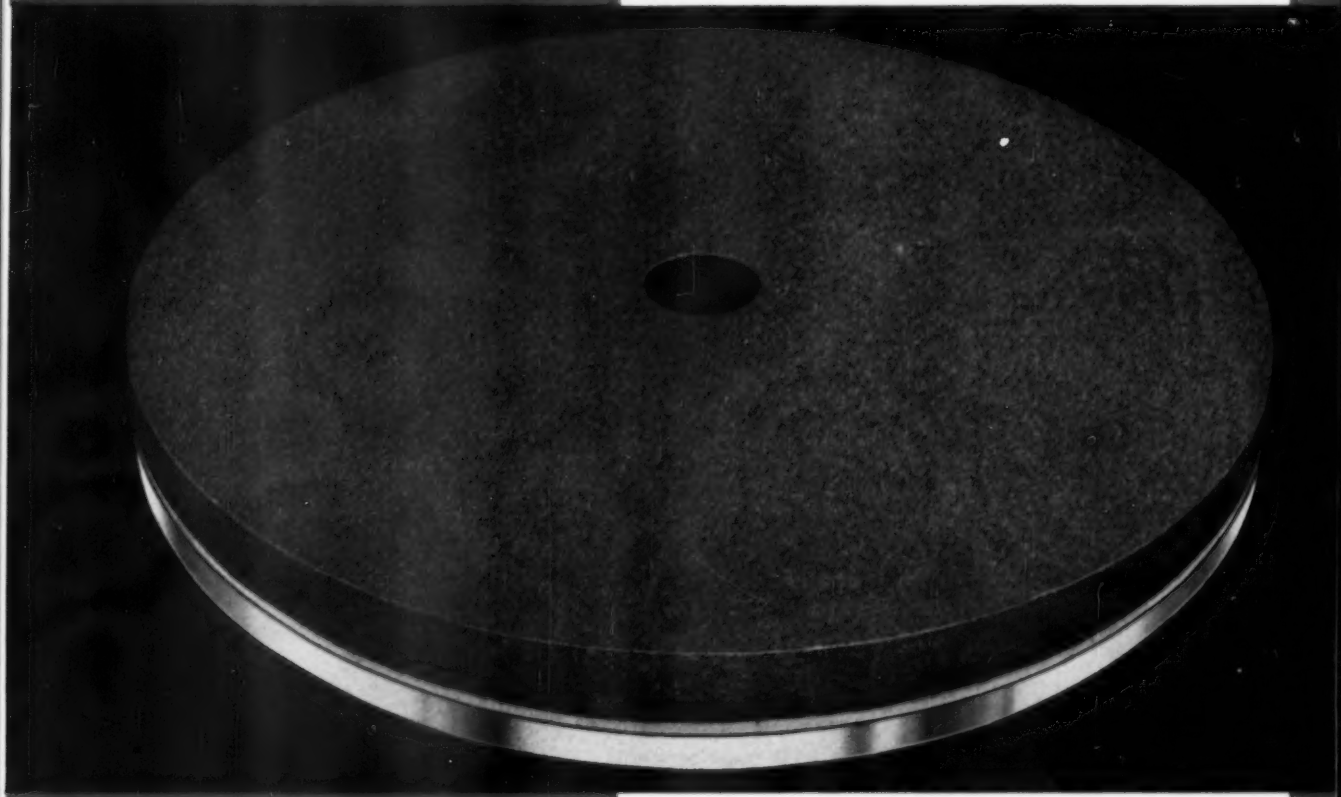
- Eliminates "forced," "chattered" and "stripped" threads as well as broken taps—no damage to starting threads when withdrawing tap.
- TAP-SAVER head does either right or left-hand tapping, drilling, reaming, spot facing and counterboring. Cuts hole time by half.
- One dial setting covers all work on any material. Absolute safety under all conditions with all tools, in through or blind holes.
- Three sizes of tapping heads are supplied as standard with Morse taper shanks Nos. 3 through 7. Special shanks or draw key slots for any machine are available on order. Each head furnished in steel box with three drill collets and seven tap collets in appropriate sizes.

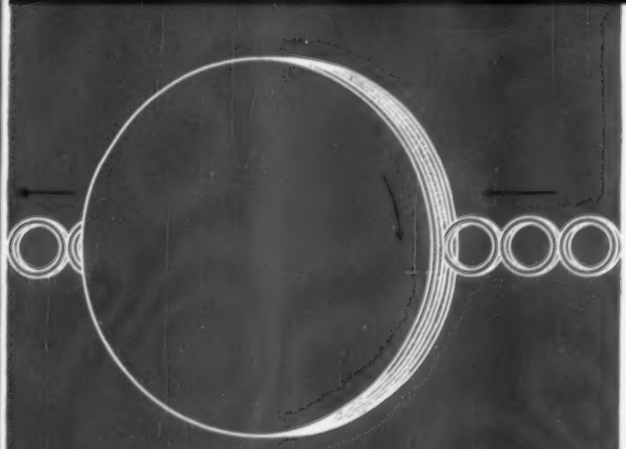
DAVIS BORING TOOL DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wisconsin

46% more disc life after changing to Gardner

Reduces down time, lowers unit cost





Precision grinding both sides of bearing races in one operation.

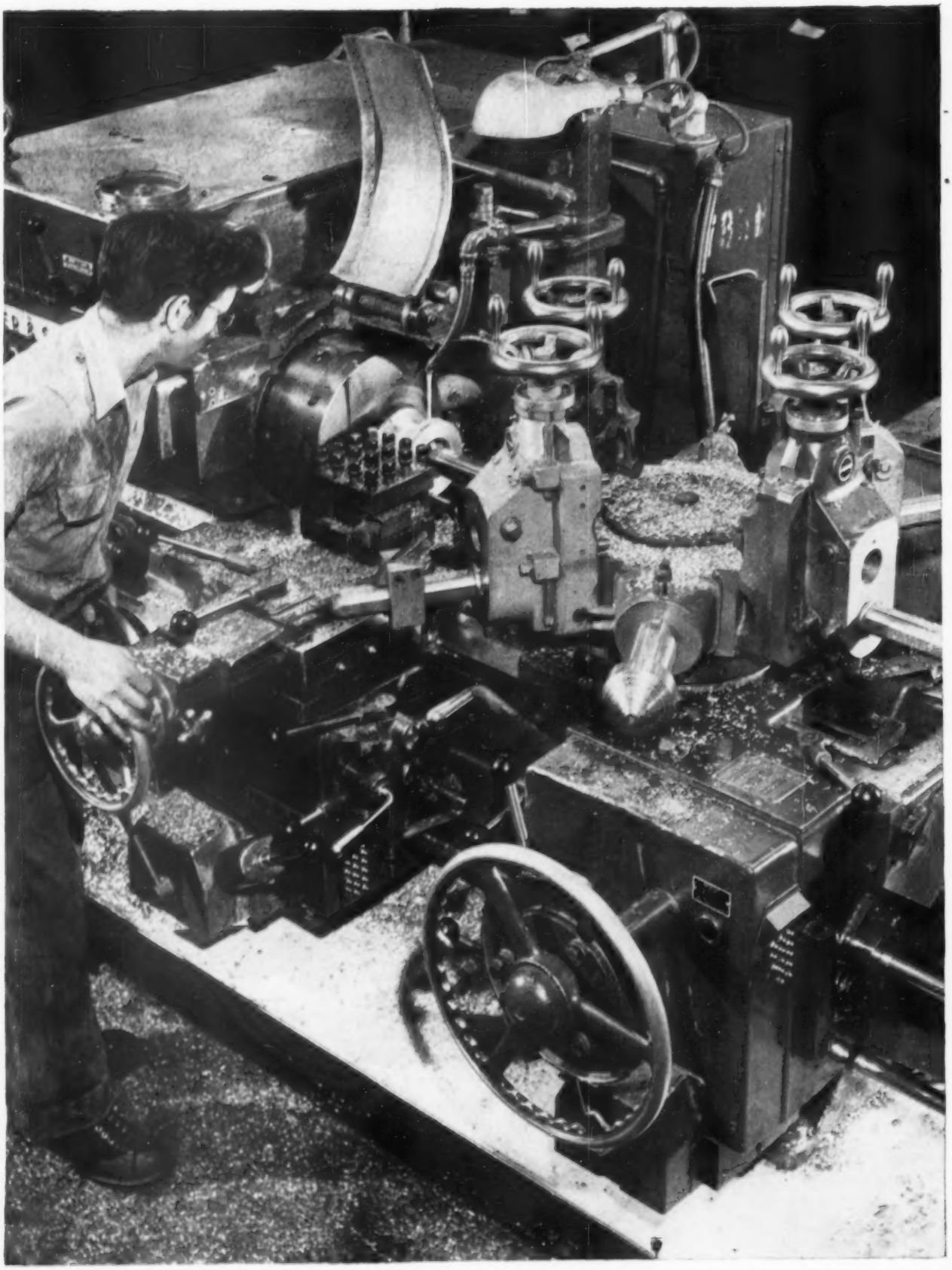
the problem:
To increase disc life in double disc grinding parallel sides of bearing races of various sizes.

the solution:
Gardner Abrasive Specialist recommended new specification which produced an average of 280,000 pieces per set of discs, compared to 191,000 per set of discs previously used.

GARDNER

abrasive discs

BELOIT, WISCONSIN



WARNER & SWASEY 1-A

efficiently handles small lot brass work at Beloit Iron Works

GIANT, city-block-long paper making machines made by Beloit Iron Works, Beloit, Wisconsin, require hundreds of different precision machined parts—in extremely small lots. For much of their turning work, Beloit depends on a large battery of Warner & Swasey turret lathes, machines ideally suited to the different classes of small lot work they have.

The machine shown—a new Warner & Swasey 1-A Universal Extra Heavy Duty Turret Lathe—was selected to handle an especially critical turning problem. This involved the production of brass castings in lots less than 15 pieces, where the qualities of high speed and great power are required, in addition to extreme machine maneuverability. The new Warner & Swasey 1-A is designed to meet just such demands!

Its zoned operating controls put all machine controls within easy reach. Operators can quickly and easily set the cross slide, the hex turret unit, or position tools. The 1-A's all-clutch headstock permits instantaneous speed changing for fast, effortless headstock handling. And for threading or forming cuts, a 4 to 1 speed reduction can be obtained instantly without preselection merely by flipping the speed change lever in the opposite direction. The power chuck wrench further speeds handling time, cuts operator fatigue.

This machine is also equipped with longitudinal dials for setting lengths of cut, eliminating the setting of stops—another reduction of handling time on this small lot work.

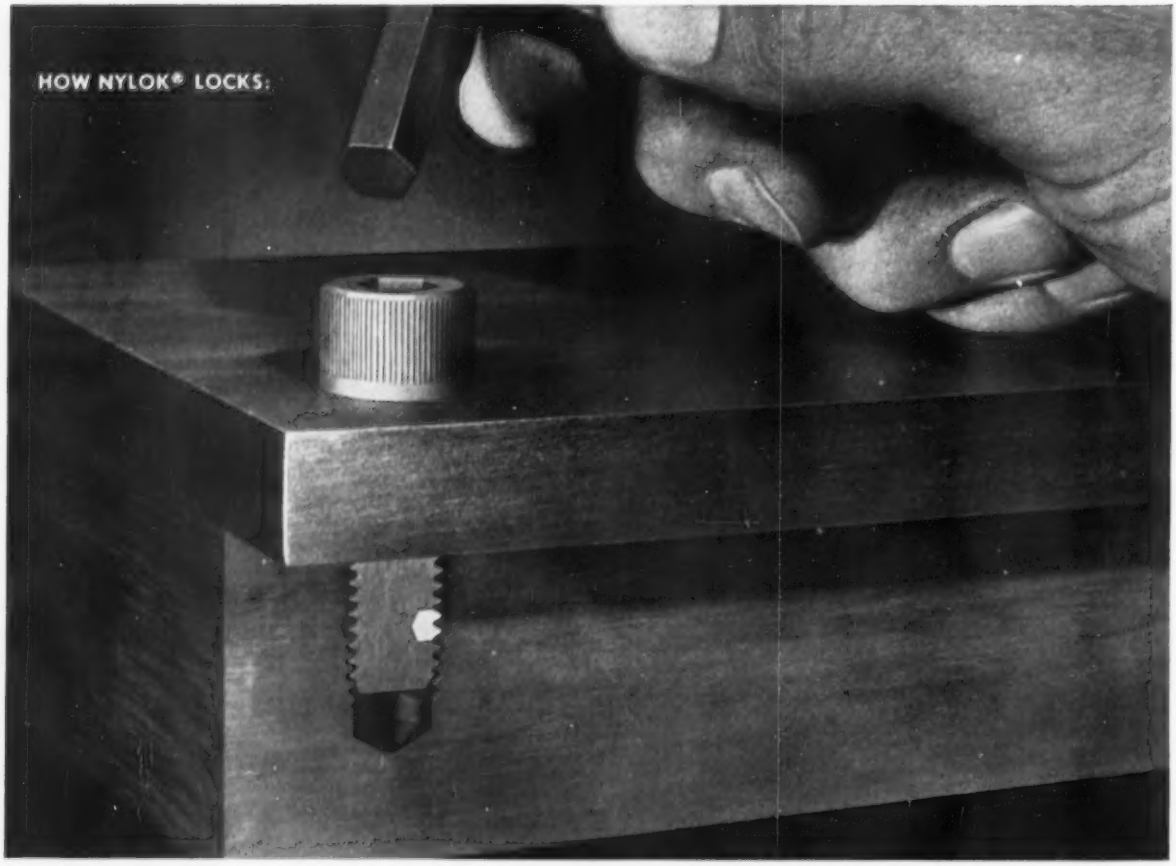
A 30 hp, two-speed motor furnishes all the power necessary for high speed brass turning plus a range of 32 unduplicated cutting speeds from which the most efficient speed can be quickly obtained for every cut. Its rigidity and Vee-Way construction assure holding required accuracies of .001.

This 1-A, like the other Warner & Swaseys, has proved its efficiency for Beloit Iron Works because it is matched with the type and range of work for which it is designed. Our Field Representative will be glad to work with you to select the machine tools that will similarly best suit your needs.

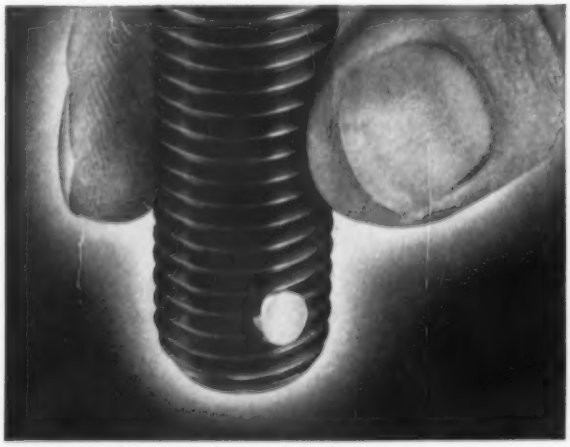
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

NEW—a complete line of socket screw products



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.



BEFORE ASSEMBLY. The nylon pellet projects slightly beyond male threads. When assembled, female threads will be impressed into it. Pellet locks effectively whether the screw is seated or not.

AFTER REMOVAL. "Plastic memory" of pellet has expanded impressed threads to greater diameter than screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

self-locking UNBRAKO that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok * self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

An UNBRAKO screw with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Just thread the UNBRAKO into any tapped hole. *Seated or not*, it locks positively wherever wrenching stops. The tough, resilient nylon pellet forces mating threads together and holds tight. The screw will not shake loose.

You save production time when you build products with self-locking UNBRAKOS. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-locking UNBRAKOS are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

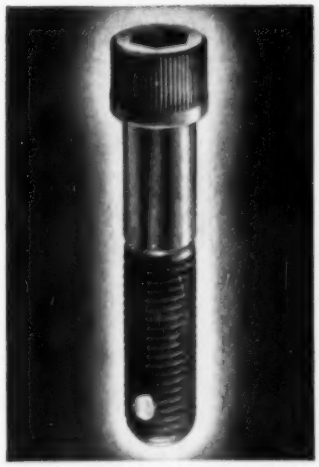
**T.M. Reg. U.S. Pat. Off., The Nylok Corporation*

UNBRAKO SOCKET SCREW DIVISION

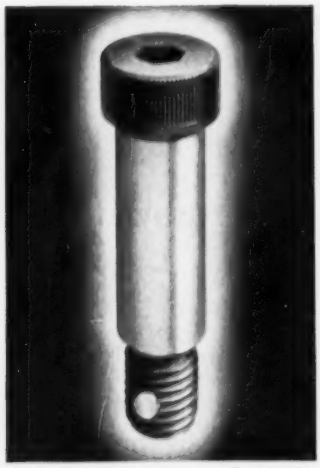
STANDARD PRESSED STEEL CO.

SPS

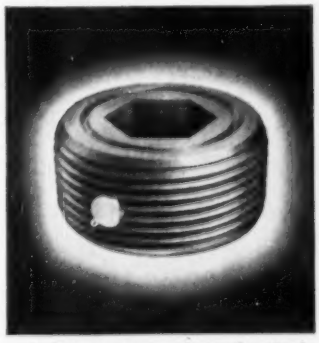
JENKINTOWN PENNSYLVANIA



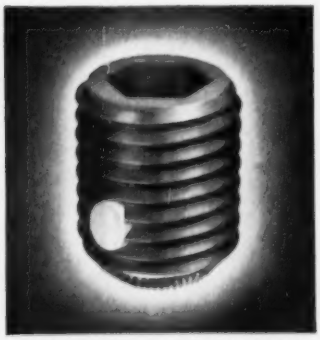
Socket head cap screws. Standard sizes # 6 to 1 in.



Socket shoulder screws. Standard sizes ¼ to ¾ in.

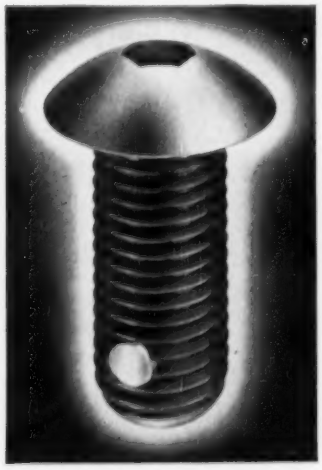


Socket pressure plugs. Standard sizes ⅛ to 1¼ in.



Socket set screws. All standard point types. Standard sizes # 6 to 1 in.

Flat head socket screws. Standard sizes # 6 to ¾ in.



Button head socket screws. Standard sizes # 6 to ⅜ in.

LAPOINTE-BROACHING
on a double ram
...the economical way to machine this

Production 192 per hour at 80% efficiency!

4 teeth are broached in solid bar stock (SAE 5120). There are two broach assemblies on each ram. One broach finishes the face square with the bottom and roughs out the tooth; the other broach finishes the tooth at a 7½ degree angle in relation to the front face.

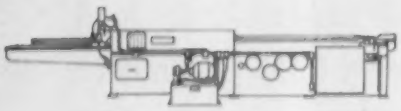
At a broaching speed of 35 feet-per-minute, and with two complete parts broached per cycle, the result is better than 3 finished parts per minute. Cost-conscious production men will certainly be interested in this example of conversion to Lapointe-broaching!

THE LAPOINTE MACHINE TOOL COMPANY

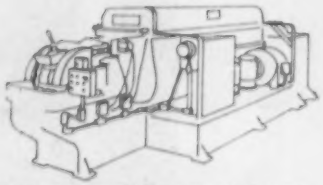
HUDSON, MASSACHUSETTS • U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

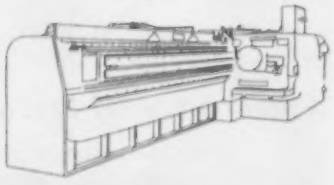
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



60" STROKE HORIZONTAL, ELECTRIC



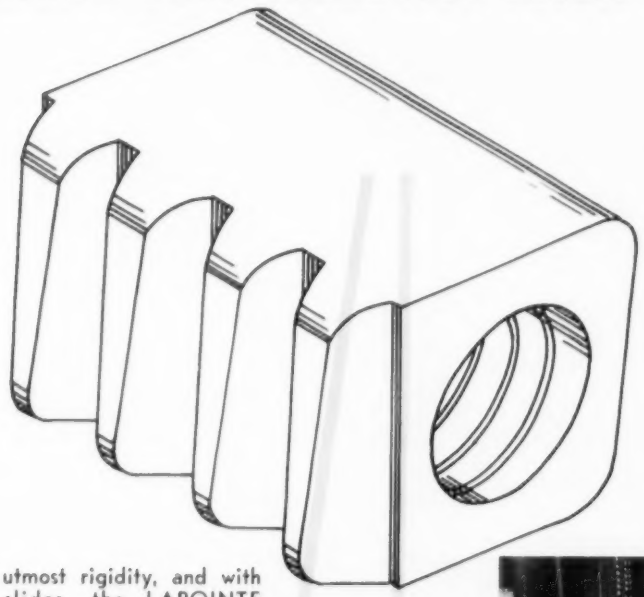
CH CONTINUOUS BROACHING, ELECTRIC



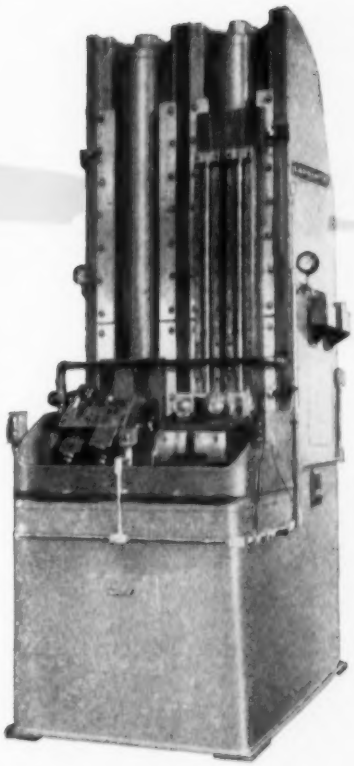
SRHE SINGLE RAM HORIZONTAL, ELECTRIC

vertical machine

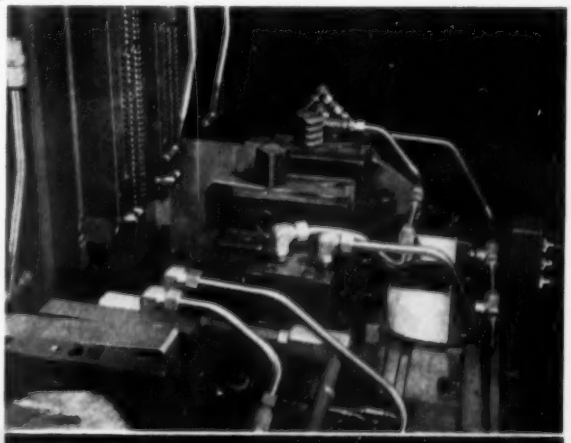
STEERING GEAR BALL NUT RACK



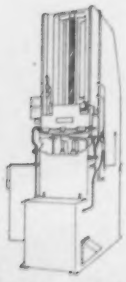
Note Angle



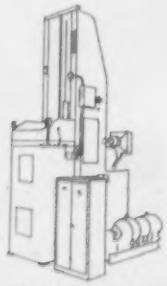
Built for utmost rigidity, and with massive slides, the LAPOINTE Double Ram (or Single Ram) Vertical Broaching Machine is engineered for extremely high production in surface broaching. It is available in 3- to 25-ton capacity, 48- to 90-inch stroke. Variable speed. Equipped with the patented Lapointe Tip-Down Table or, optionally, with the Lapointe In-and-Out Table. Hydraulic clamping. It is extremely flexible . . . simple to change over to another job. Also, moderate in cost, considering production output.



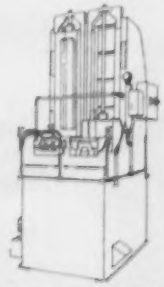
Closeup of fixtures on both rams.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC

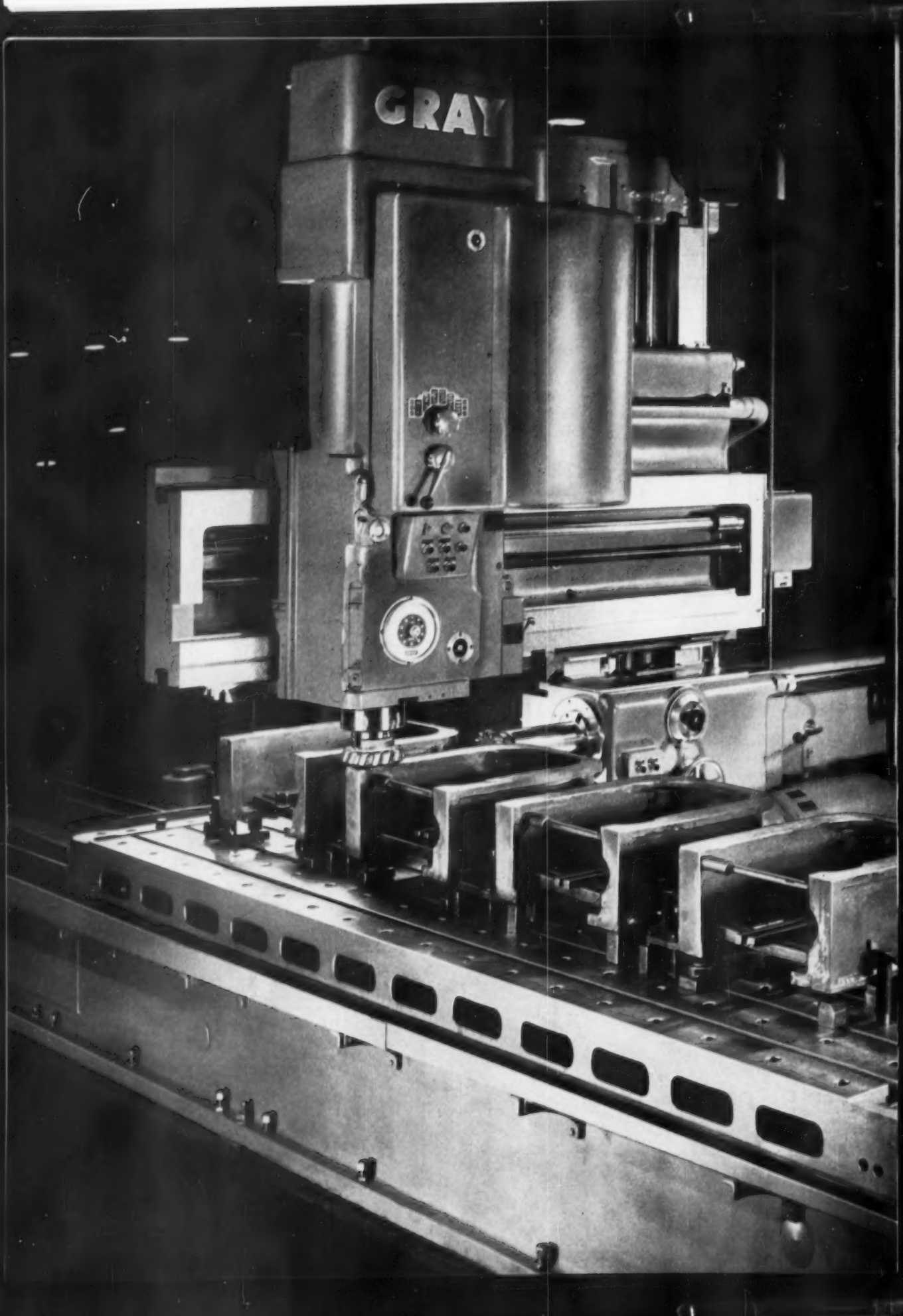


DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

known to be the best in

BROACHING


GRAY

If you're tired of seeing small jobs on your large expensive millers . . .

If you're tired of extra set-ups because your miller has only a single head . . .

If you're tired of whittling away at rugged jobs with low power heads . . .

If you're tired of complicated controls that make your operator a mountain goat . . .

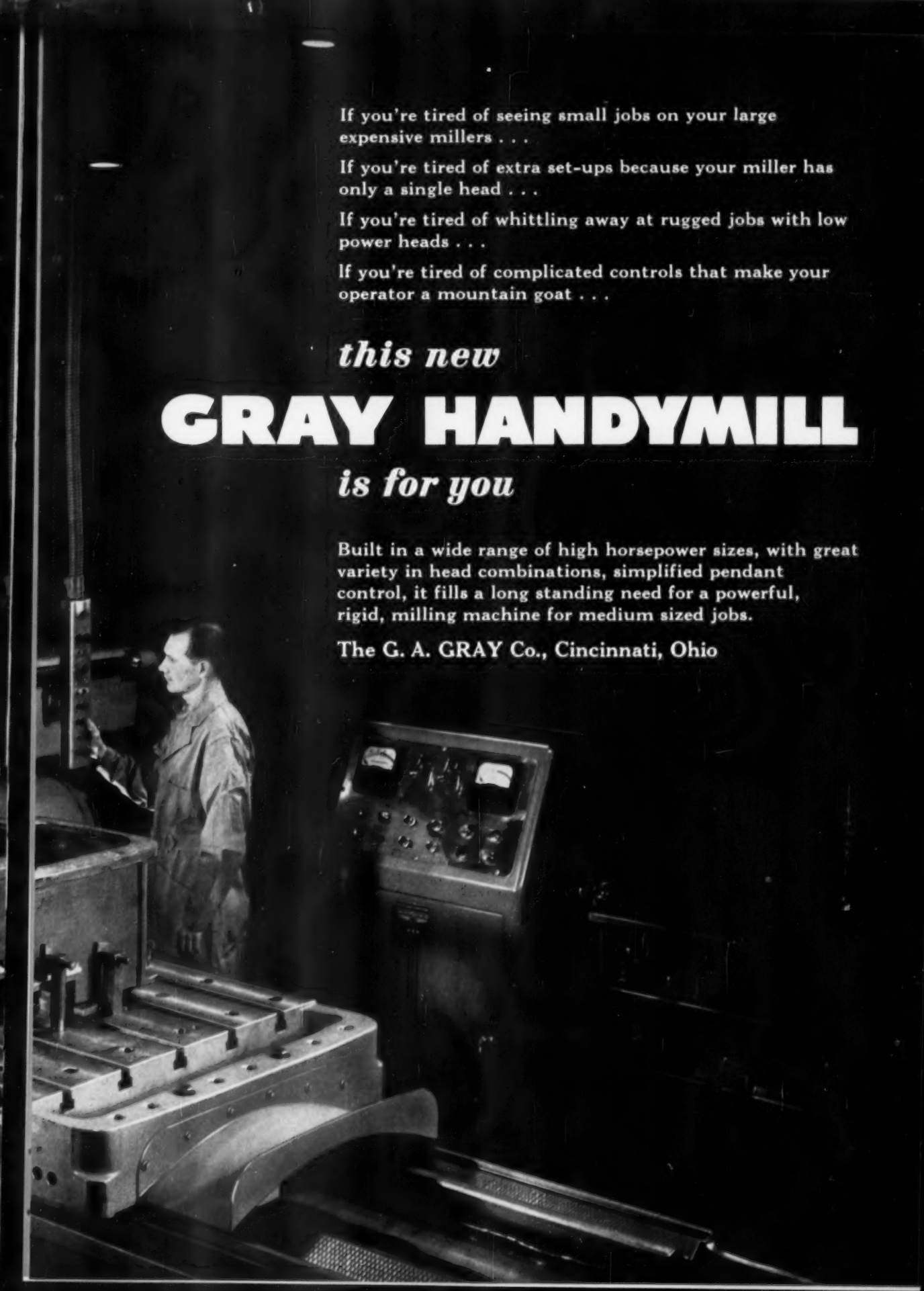
this new

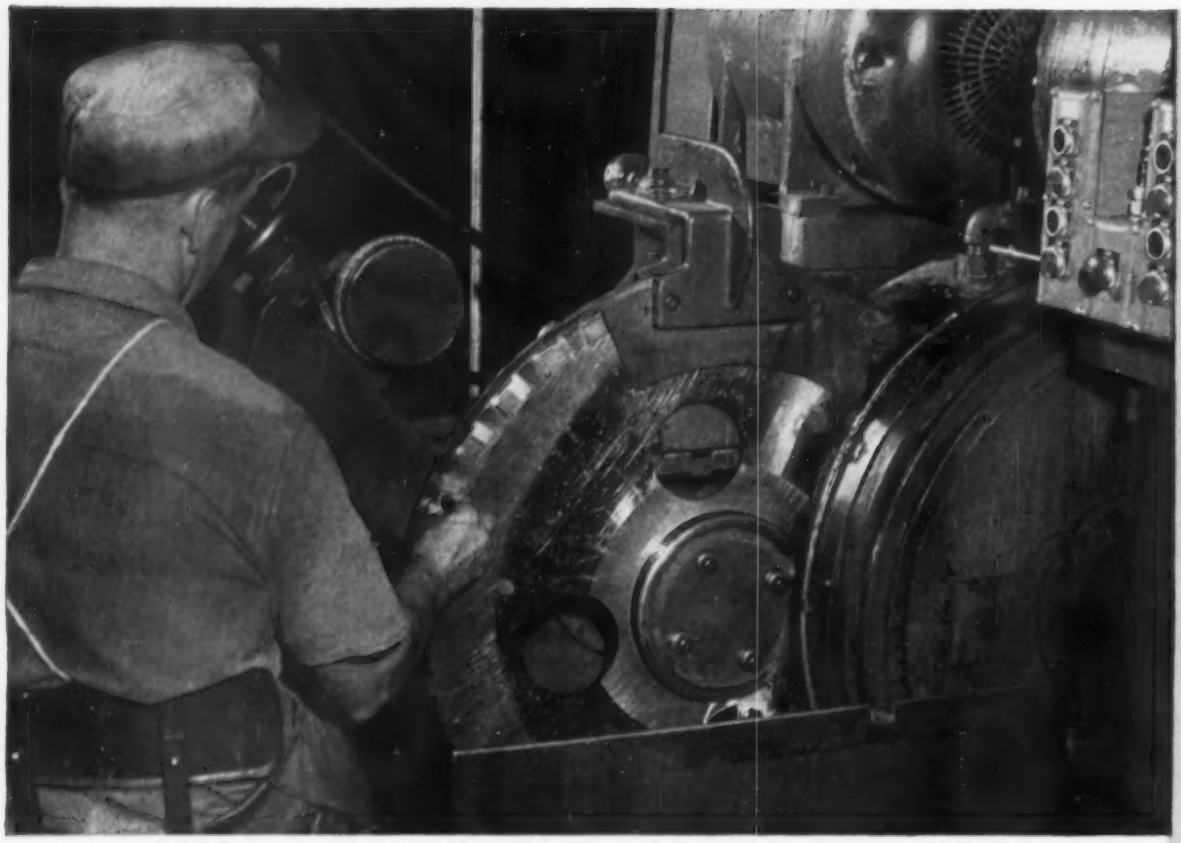
GRAY HANDYMILL

is for you

Built in a wide range of high horsepower sizes, with great variety in head combinations, simplified pendant control, it fills a long standing need for a powerful, rigid, milling machine for medium sized jobs.

The G. A. GRAY Co., Cincinnati, Ohio





HEAVY STOCK REMOVAL with precision tolerance on this double spindle disc grinder is a faster, easier job when a Norton disc adds the "Touch of Gold." Norton covers the entire range of disc grinding applications, from snagging to lapping.

"We find Norton discs outproduced others 2 to 1"

One of many job reports showing how Norton discs add the profit-boosting "TOUCH of GOLD"

MORE OF THE SAME:

- "Norton discs the best ever received. Produced over 6,000,000 piston rings — 100% more than our former discs, with 50% less dressing. Results duplicated in subsequent shipments."
- "Outlasted and outperformed all other discs. Gave 366,975 pieces without burn."
- "Averaged 21,500 pieces, a new high for this job."
- "High above competition for output and grinding quality."
- "Gave 20% longer service life."

What Norton discs have done for others, they can do for you.

That goes for any material you're grinding, on any type of disc grinding machine.

LAPPING ENDS OF TRANSFORMER COILS on a Norton 60-F HYPRO-LAP* lapping machine equipped with a Norton disc. Only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost.

Norton discs of ALUNDUM* and CRYSTOLON* abrasives are made in all standard grit sizes, all grinding grades, five types of bonds and all types of mountings. They are precision-built for closest uniformity — so you can depend on the same cool cutting action and extra long service life every time you re-order.

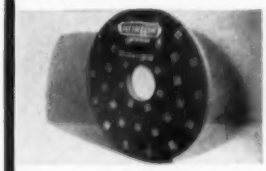
See Your Norton Distributor

for valuable aid in selecting the right discs for your jobs. Ask him for the booklet, *Disc Grinding*. Or write to the nearest district office of NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning Company, Troy, N. Y., division of Norton Company. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

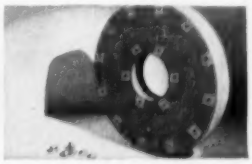
W-1723

*Trade-Marks Reg. U. S. Pat. Off. and Foreign Countries

For Every Job — Norton discs are made in all types of mountings, six of which are shown here.

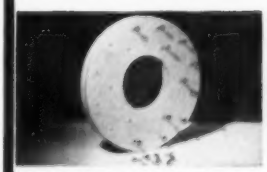


Resinoid (Inserted Nut)

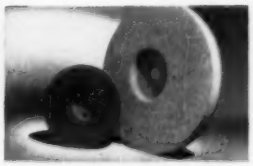


Vitrified (Inserted Nut)

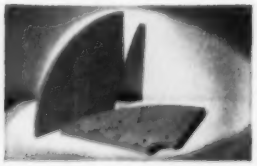
Silicate (Inserted Nut)



Solid Plate Mounted (Projecting Stud Type)



Solid Plate Mounted (Loose Screw Type)



Segmental Plate Mounted

NORTON

ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING PRODUCTS: Coated Abrasives • Sharpening Stones • Behr-cat Tapes

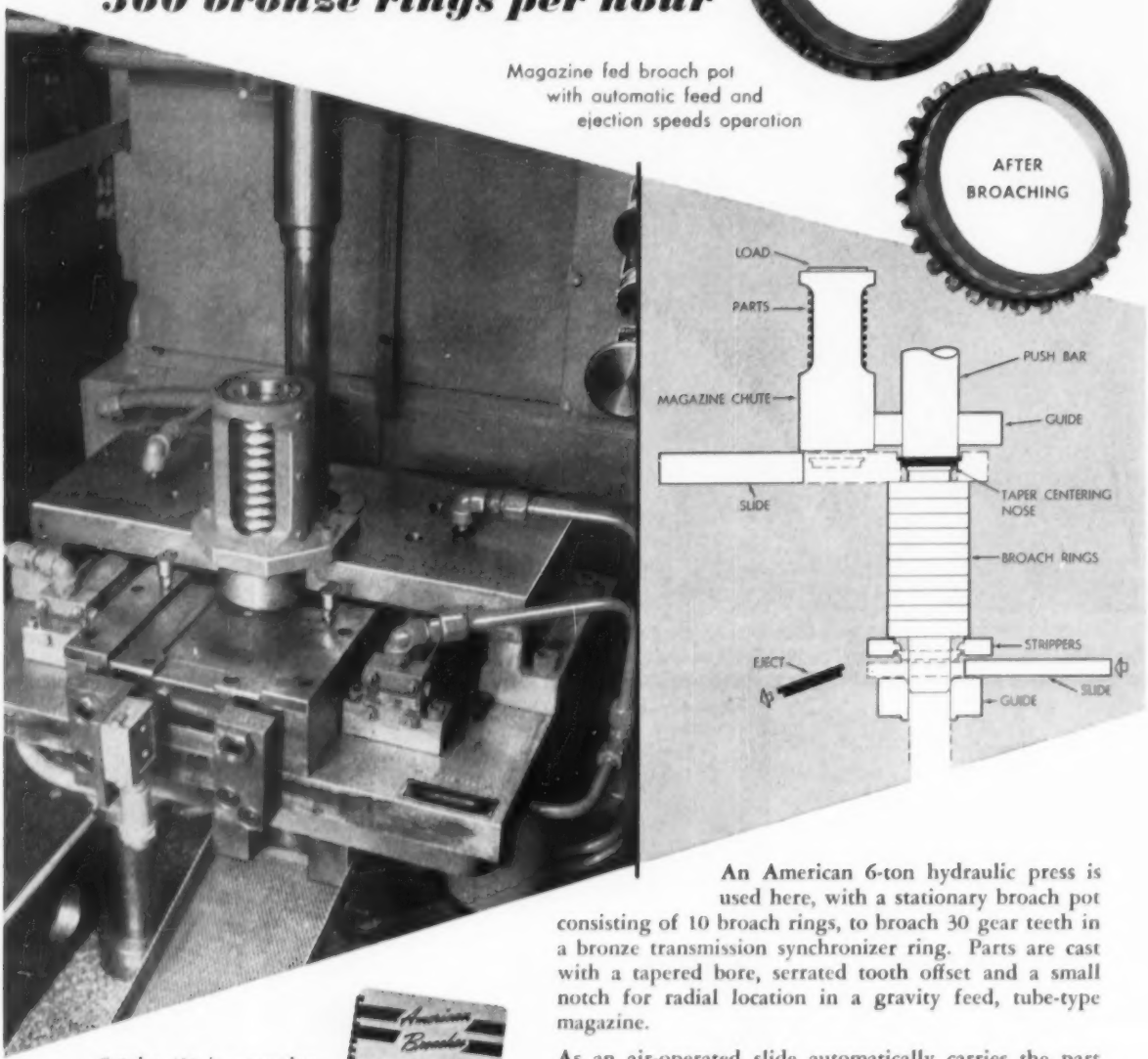
ANOTHER *American* FIRST

30 gear teeth broached

IN EACH OF

360 bronze rings per hour

Magazine fed broach pot with automatic feed and ejection speeds operation



An American 6-ton hydraulic press is used here, with a stationary broach pot consisting of 10 broach rings, to broach 30 gear teeth in a bronze transmission synchronizer ring. Parts are cast with a tapered bore, serrated tooth offset and a small notch for radial location in a gravity feed, tube-type magazine.

As an air-operated slide automatically carries the part into broaching position, the ram of the press descends and a push bar, engaging the tapered bore of the part, forces it through the broach pot. During the cutting operation the push bar is guided above and below the broach pot. Stripper fingers remove the part as the push bar returns. Ring is ejected by a second slide.

Catalog 450 is a complete and interesting manual on all types of broaching. Write for your copy today.

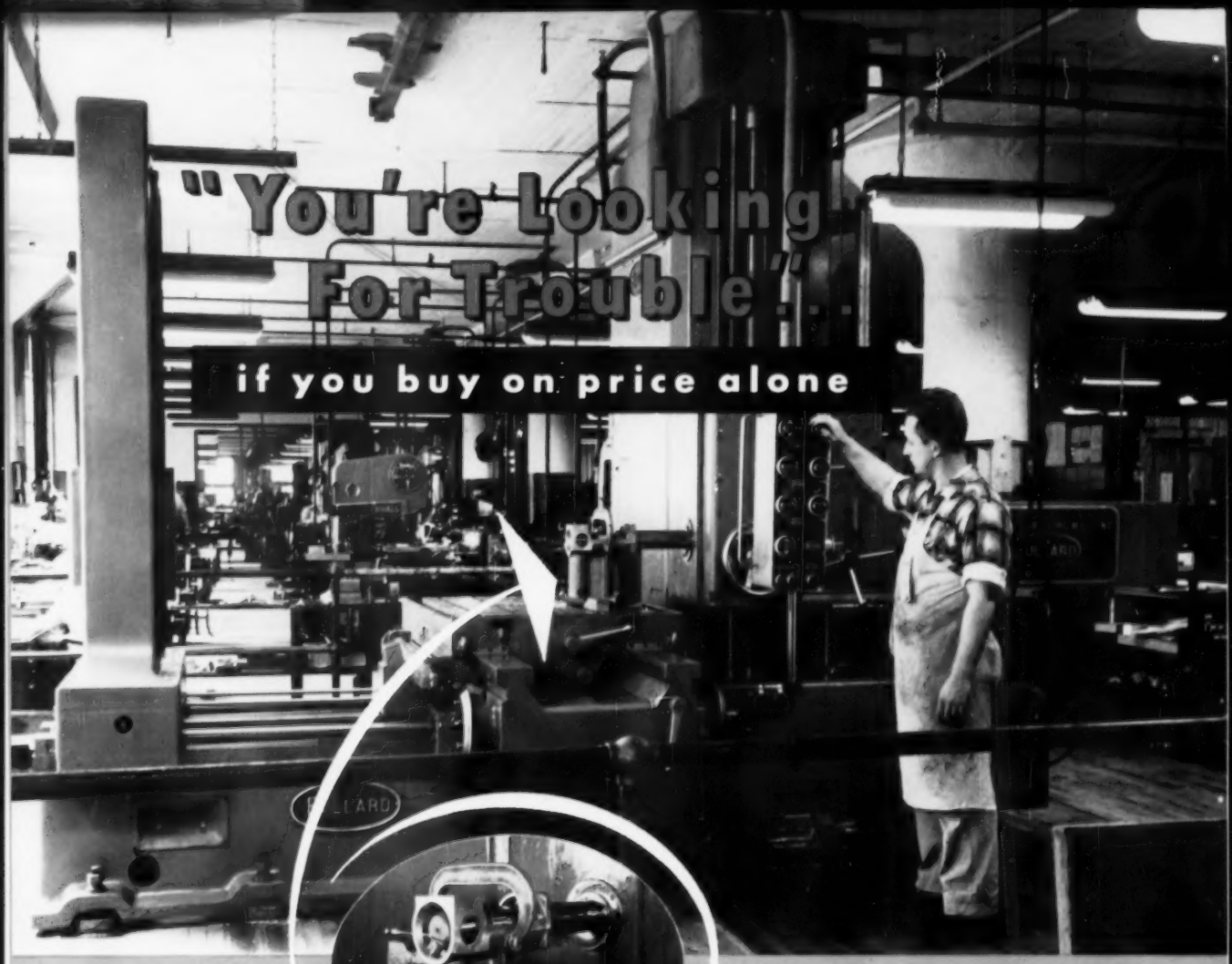
AMERICAN *American* BROACH & MACHINE CO.

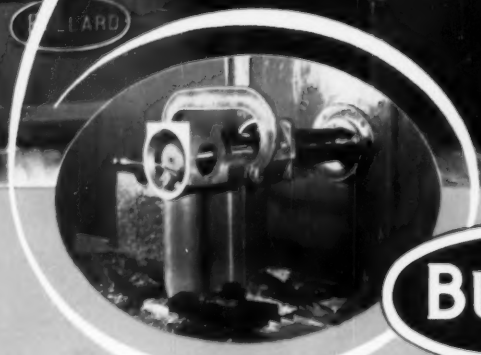
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

SUNDSTRAND

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery





BULLARD

"Like many other firms," says Mr. A. Balas, Equipment Engineer at Mergenthaler Linotype Co., N.Y.C., "we are constantly on the alert for new equipment, new processes and new ideas. This constant search for improvement convinced us of the need to purchase a versatile, time-saving, cost-saving and, above all, accurate Horizontal Boring Machine. We checked them all — feature for feature — and then bought the Bullard H.B.M., Model 75. We feel it has enough "built in reserves" to take care of any contingency or new development which may come up. It's reassuring to know that an investment of this size won't go out of style next month."

Why don't you get the full story on the many features and advantages offered you with a Bullard H.B.M., Model 75 in your plant. For a complete line catalog, just call your nearest Bullard Sales Office, Distributor or write

THE BULLARD COMPANY BRIDGEPORT 9, CONN.

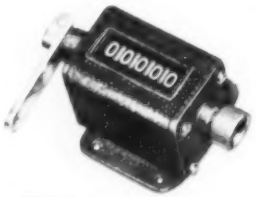
See this "Show-Case" of VEEDER-ROOT COUNTERS...

at your Industrial Supply Distributor

Useful "facts-in-figures" on practically every machine, operation, system or process in industry can be supplied by Veeder-Root Counters for mechanical, electrical and manual operation. And now Veeder-Root Counters can be supplied from stock by certain leading Industrial Supply Distributors. Find out from your own distributor how they can add to the efficiency and *Count*rol of your plant operation. And if you are selling or designing equipment, contact Veeder-Root for engineering recommendations.

Insist on Standard VEEDER-ROOT COUNTERS

from your Industrial Supply Distributor or write us on special problems

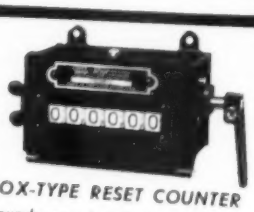


SMALL RESET COUNTER

A compact, rugged reset counter for moderate duty in parts inspection, quality control, conveyors, machine tools, light presses, etc.

Dimensions: 1¾" long, 1 19/64" high, 1 1/16" wide

Speed: Up to 1000 counts per minute.



BOX-TYPE RESET COUNTER

For punch press installations, conveyors, metal-working equipment, die casting, plastic-molding, rivet, spring and wire machining, or any installation requiring a heavy duty counter.

Dimensions: 4¼" long, 2 1/32" high, 3⅜" wide.

Speed: 500 counts per minute.

RESET MAGNETIC COUNTER

For remote indication of machine operation from plant to office.

Dimensions: 3 15/16" long, 2½" high, 1⅛" wide.

Speed: Up to 1000 counts per minute.

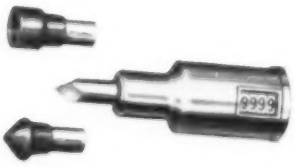
Coils: 110V-AC are standard. Other voltages are available. Panel mounting feature also available.

HAND TALLY

For quick spot-checks of production or performance.

Dimensions: 1 1/64" long (to end of reset knob), 1¼" deep, 2" high.

Counts one for each depression of the thumb lever, and resets to zero by a turn of the knob.



CLUTCH SPEED COUNTER

For checking to make sure that the machine is operating at the required R.P.M.

Dimensions: 3¼" long, ⅛" max. diameter. Non-Reset.

Internal clutch operates counter only when rubber tip is pressed against the shaft.

Everyone Can Count on

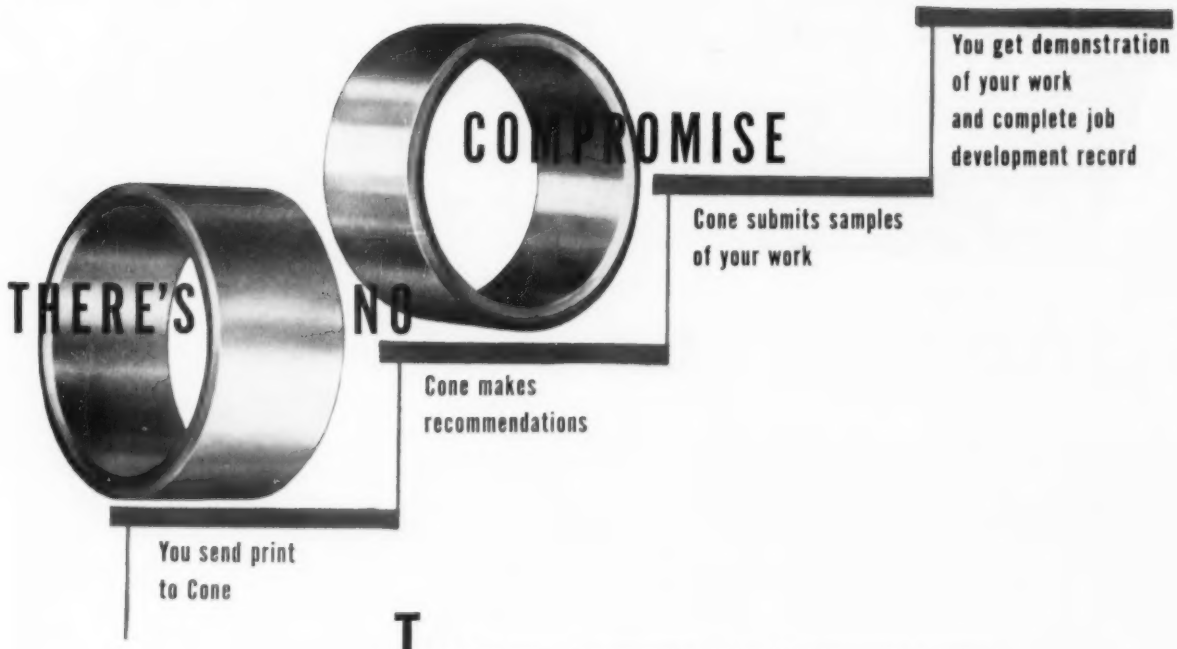
VEEDER-ROOT

"The Name that Counts"

HARTFORD 2, CONN.

Stocked at Hartford 2, Conn. • New York 19, N. Y.
Greenville, S. C. • Chicago 6, Ill. • Montreal 2, Canada
Offices and Agents in Principal Cities

No. 6 in a series


THERE'S NO COMPROMISE
You get demonstration of your work and complete job development record
Cone submits samples of your work
Cone makes recommendations
You send print to Cone

There is no adequate compromise with efficient production practices, if you are in business for a profit.

But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part	Bushing	Length	⅜"
Machine	1⅜" Conomatic	Hole Dia.	1¼"
Tools	100% Carbide Tipped	RPM	825
Material	8620	Time	14.8 Secs.
Stock Size	1⅜"		

Conomatic

For particulars send for "Four Steps With Cone"

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

VICKERS® ...the MOST EXTENSIVE LINE of hydraulic units complying with JIC STANDARDS

Shown here are only a few representative standard Vickers units that comply with JIC Standards . . . standards that are directed toward ease of maintenance, safety, longer life and uninterrupted machine production. "Undivided Responsibility" is another important advantage gained by specifying Vickers Units throughout a hydraulic system. For further information ask for new Bulletin 5002.

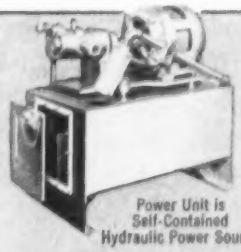
PUMPS

Vane Pump

Two Stage Vane Pump (2000 psi)

Double and Two-Pressure Vane Pumps

Variable Delivery Piston Type Pump



Power Unit is Self-Contained Hydraulic Power Source

PRESSURE CONTROLS

Balanced Piston Type Relief Valve

Hydrocushion Type Sequence Valve

Hydrocushion Type Counterbalance Valve

Pressure Reducing Valve

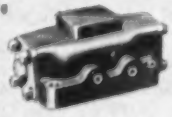
Flow Control Valve with Hydrostatic Compensator

DIRECTIONAL CONTROLS

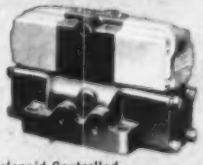
Rotary Type Four-Way Valve

Plunger Type Four-Way Valve

Manually Operated Four-Way Valve



Pilot Operated Four-Way Valve



Solenoid Controlled Pilot Operated Four-Way Valve

Solenoid Operated Four-Way Valve

Check Valve

Deceleration Valve

MOTORS

Constant Displacement Piston Type Motor

Variable Displacement Piston Type Motor

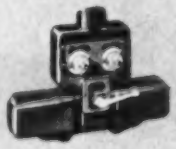
Balanced Vane Type Motor

Hydraulic Cylinders

ACCESSORIES

Accumulators

High Pressure Type Micronic Oil Filters



Traverse and Feed Cycle Control Panel

7396R

WRITE for your copy

Vickers Circuitool consists of a handy, transparent plastic guide and a 24-page manual to speed the drawing and to promote symbol (JIC) uniformity of hydraulic circuits. Circuitool will be sent only when requested on company letterhead.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

ADMINISTRATIVE and ENGINEERING CENTER

Department 1410 • Detroit 32, Michigan

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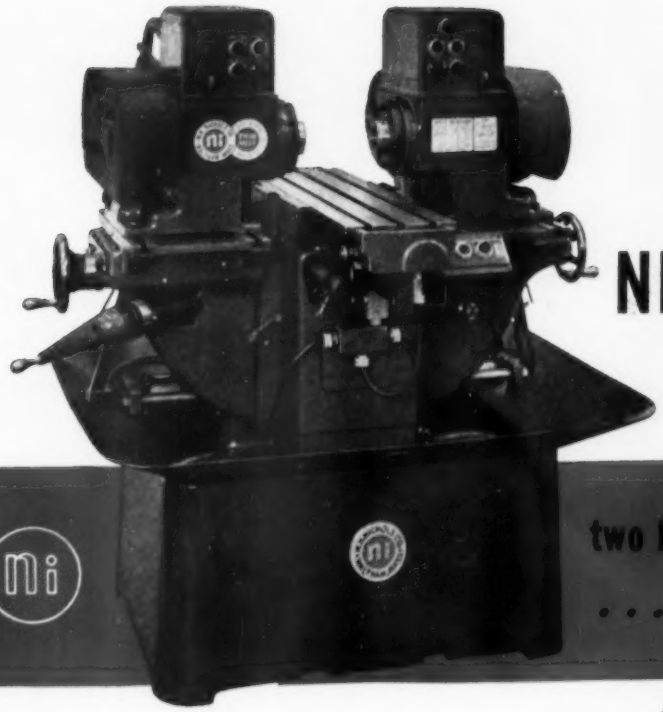
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



NICHOLS TWIN MILL

two heads are better than one ....for sure!

The Nichols Twin Mill is something new in duplex millers — a precision 2-spindle bed-type miller designed for simultaneous light duty milling of opposite or adjacent surfaces, using **horizontal or vertical spindles.**

The Twin Mill provides unmatched flexibility! It is equally adaptable for long-run or short-run jobs. The two geared milling heads are independent units, with separate 1 HP motor drives, and are quickly adjusted either directly opposed or offset longitudinally, vertically or transversely. Set-up is fast and simple.

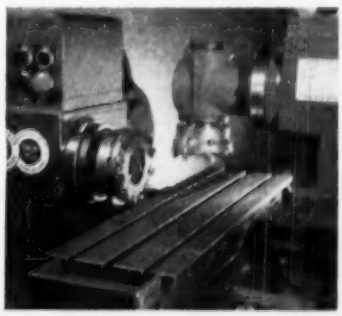
The wide range of spindle speeds from 55 to 2050 R.P.M. allows milling of ferrous or non-ferrous materials with high speed or carbide tipped cutters, producing EXTRA FINE FINISH while maintaining the closest tolerances with ease.

The Twin Mill is completely push-button controlled, arranged for automatic table cycling — with rapid approach, hydraulically controlled variable cutting feed and rapid return. Available with automatic retraction of milling heads, automatic spindle brakes and carefully engineered special features to meet specific applications.

The parts shown are typical of those on which the Twin Mill is cutting costs and boosting production. Investigate the savings it can make for you. For details write to Nichols-Morris Corporation.

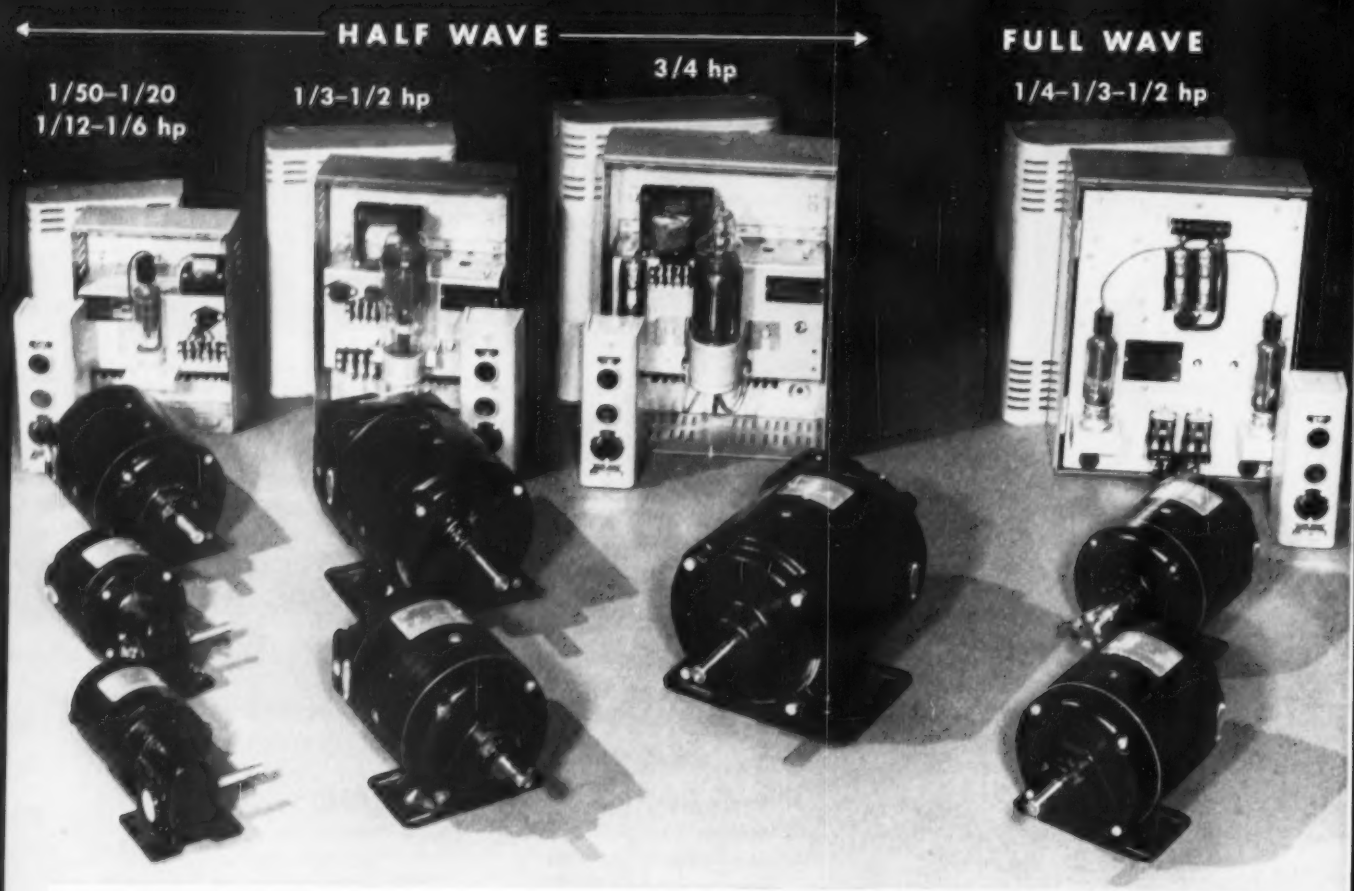
CONDENSED SPECIFICATIONS

Table, working surface	8⅝" x 30"
Table Travel—cutting stroke	11¾"
Motors	(two) 1 HP
Spindle Speeds (15)	from 55 to 2050 RPM
Max. height center of spindle above table	11¾"
Max. offset of spindles (horizontal)	8½"
Max. distance between spindle noses (across table)	16"
Floor space required	64" x 56"



Manufactured by W. H. Nichols Company, 48 Woerd Avenue, Waltham 54, Mass.

76-F Mamaroneck Ave. NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION** **White Plains, New York**



A DRIVE TAILORED TO EVERY JOB is the achievement of General Electric engineers who designed the new fhp Thymotrol drive line. Here are examples of this versatility:

Three panel sizes now cover the fhp range, making smaller ratings more compact, more economical than ever before.

Full range of ratings

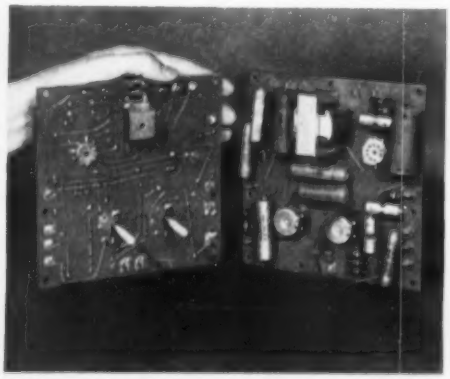
- Horsepower: 1/50 to ¾†
- Power supply: 220 v a-c, 50/60 cycles
- Speed range: 20 to 1
- Speed reg. (NL to FL): half-wave — 3%, full-wave—5% (adjustable to flat at any specific speed)

†Plus a full line of integral-hp drives.

Building-block design—you get the exact performance you want by selecting any combination of these optional features:

- Reversing operation
- Jogging (pre-set or run)
- Dynamic braking
- Tachometer follower
- Overload relay protection
- Tube warm-up protection

ONE-TUBE DESIGN of G-E half-wave Thymotrol drives minimizes tube maintenance. This type drive is suitable for most adjustable-speed jobs.



PRINTED CIRCUITRY, DIP SOLDERING are effective techniques which permit new lower General Electric prices. Exhaustive tests prove the sturdiness of this construction for industrial use.

PLUG-IN PANEL BOARD can be quickly removed for maintenance or replacement to minimize downtime—a must on such jobs as production conveyors.

GENERAL ELECTRIC ANNOUNCES . . .

NEW full line of fractional-horsepower G-E Thymotrol* adjustable-speed drives—more compact, more rugged, more reliable, easier and more economical to maintain, yet priced up to 18% below previous models

General Electric announces a completely re-designed line of fractional-hp Thymotrol adjustable-speed drives—***designed to save you up to 18% over prices of previous models.*** These versatile new drives are applicable to conveyors, machine tools, in fact, to almost every small machine whose performance can be improved by adjustable speed.

SELECT JUST THE DRIVE YOU NEED —AND SAVE MONEY!

Biggest cost-saving for you with new G-E Thymotrol drives is that you buy only as much drive as you need. For some applications, you'll want only the basic half-wave drive: motor, simple one-tube control, and control station. For more complex jobs, you can select any combination of seven different optional accessories to provide desired performance. To further match drive to job, these popular half-wave drives come in three panel sizes.

For rapid acceleration of high-inertia loads, for extra-smooth performance, or for flat speed-regulation adjustment, you'll want the new full-wave Thymotrol drive, with still other optional features.

NEW DESIGN IS SIMPLE, RELIABLE

In designing new G-E Thymotrol drives for mass production, G-E engineers have also included many new features for longer life, lower operating costs, increased reliability:

Plug-in panel boards on half-wave units can be quickly removed without disturbing customer wiring for fast inspection, repair, or replacement, minimizing downtime.

Printed circuitry and dip soldering result in more compact units which simplify your design problems. Shock and vibration tests show this construction really stands up in industrial use. Parts replacement is simple using soldering iron and pliers.

20:1 speed range is now standard on all ratings. And operator can turn machine to full "off" with speed-control knob.

High tube reliability—all tubes on G-E Thymotrol drives are fully guaranteed for one year, usually last far longer.

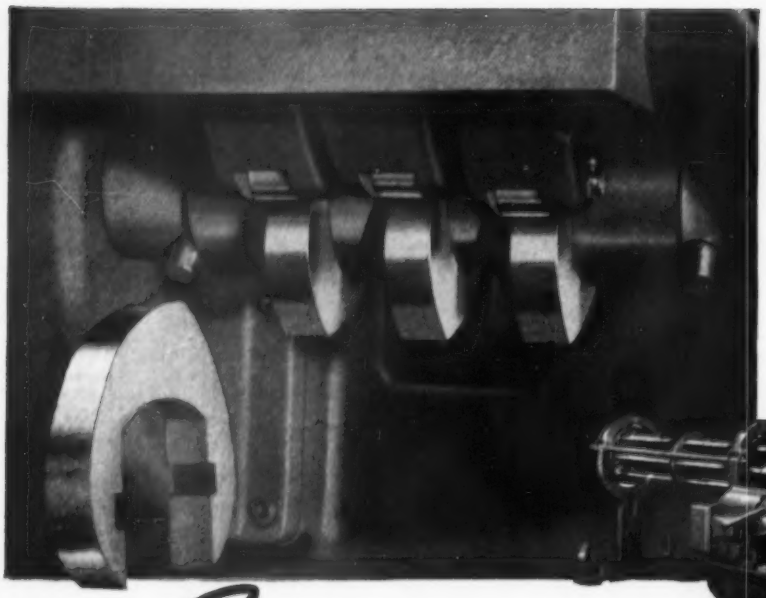
SIMPLE PACKAGED DRIVES OR ENGINEERED MULTI-MOTOR SYSTEMS

Whatever your adjustable-speed needs, from packaged single-motor drives to specially engineered multi-motor systems, you'll find the answer —***at new low prices***—at General Electric. See your G-E Apparatus Sales representative today. Or write for Bulletin GEA-6519 to Sect. 791-3, General Electric Co., Schenectady 5, N. Y.

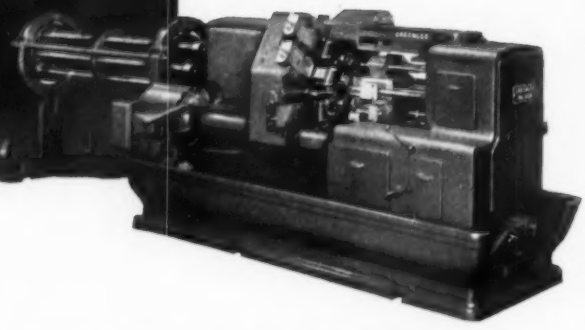
*Trade-mark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC



PRODUCTION MACHINERY
GREENLEE



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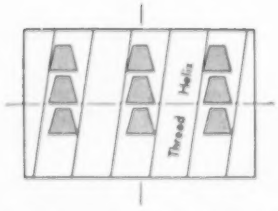
thread milling requires accurate cutter design!

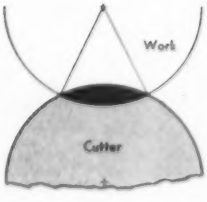
mathematical computation of cutter form

Multiple thread milling cutters often produce a thread space form which is not a duplicate of the cutter tooth form. The cutter tooth form is not a duplicate because the cutter tooth rotates in a plane which is perpendicular to the work axis and at an angle to the thread helix. This generating action produces a fillet at the bottom of the threads, and a thread space which is wider than the cutter tooth. When the amount of generating produces an unsatisfactory thread form, the cutter must be developed to produce the desired thread tooth thickness without fillet interference.

Whenever required, Barber-Colman engineers, by mathematical computation, design the correct cutter which compensates for the generating action. In this computation, the diameter of the cutter is very important since the amount of tooth form correction increases as the diameter of the cutter increases. A thread produced by a specially-developed cutter will have an accurate form which will fit the gage with the desired bearing.



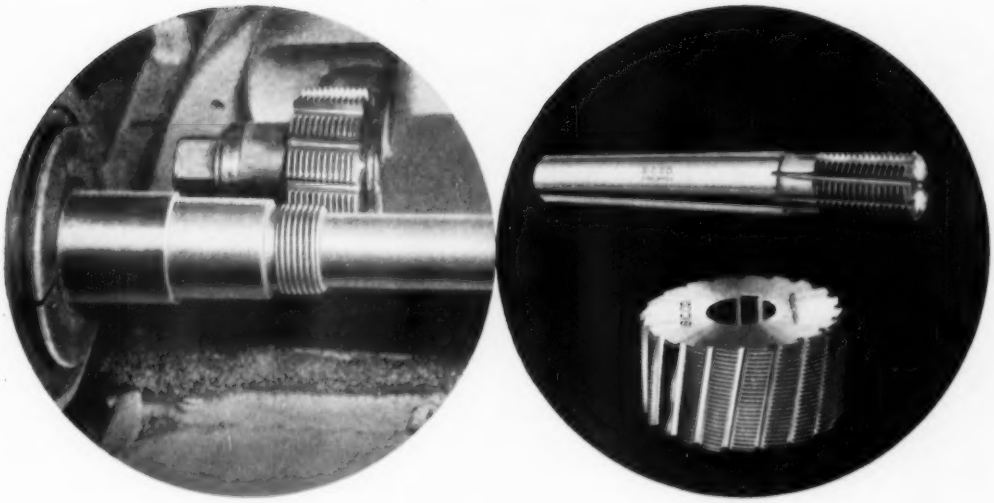
This schematic drawing shows how a multiple thread milling cutter produces a thread space which is wider than the cutter tooth. The cutter is set so that the plane of rotation of the cutter teeth is perpendicular to the work axis, and at an angle to the thread helix.



Large diameter cutters have greater length of contact and produce more pronounced fillets.

Small diameter cutters have less length of contact and produce smaller fillets.

In some cases, cutters mill deeper than true thread form. Any generated fillets which may be cut are then below the gaging surface of the thread. Correct cutter design takes care of this automatically.



original cutter accuracy in resharpening

All Barber-Colman form-relieved milling cutters are accurately index-sharpened on Barber-Colman automatic sharpening machines, so that all cutter teeth are the same height and accurately spaced. This makes it easy to maintain original cutter accuracy when resharpening either on automatic sharpeners, or on conventional sharpening equipment using the accurately indexed cutter teeth as a reference. In either case, accurate sharpening to original tolerances is easily maintained, and cutter sharpening time is reduced to a minimum.

design elements for maximum performance

With the proper tooth form developed to cut accurate threads, the engineers then analyze the job conditions to determine which cutter features will produce best cutter performance. These features include selection of the proper cutter material, shell or shank type cutters, straight or helical flutes, rake teeth, axial relief and intermittent teeth if sharp threads are desired. Since we make all classes of ground and unground thread milling cutters, we can recommend the cutter accuracy required for your job.

When you have a threading problem, consult Barber-Colman cutter engineers for their recommendations on the proper cutters for the job. Be sure the cutters you have are accurately designed to cut the correct thread form. Send us blueprints of your threaded parts for quotation on thread milling cutters designed to produce correct threads.

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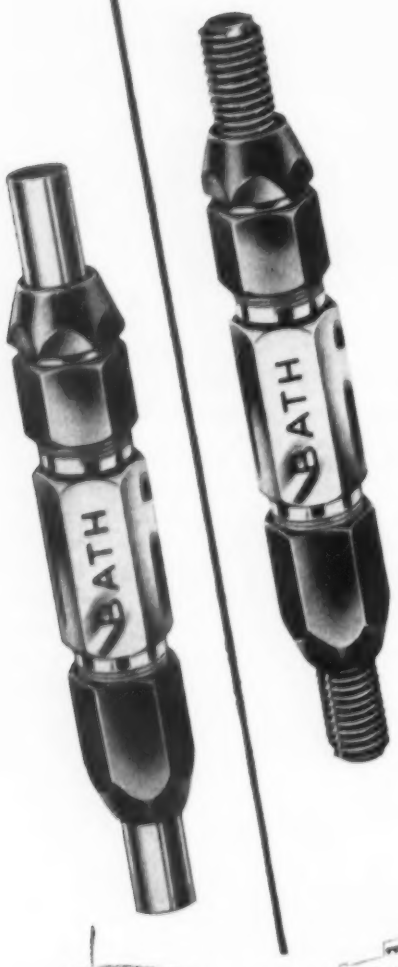

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These maintenance features show . . .

3 Ways G-E Starters Are Easy For You To Use

General Electric magnetic starters are designed to simplify maintenance. All changes are simple, and require little time and trouble. Contacts are accessible from the front for inspection or removal, and the strongbox coil is easily changed.

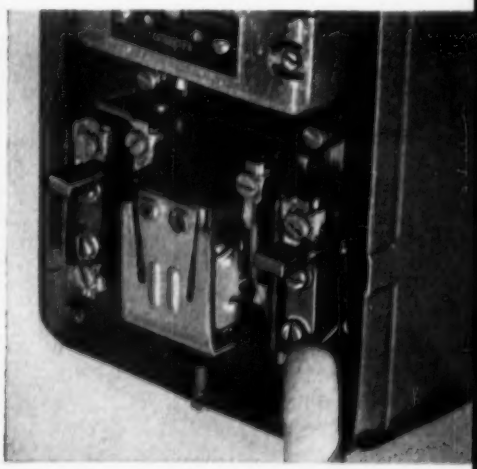
Bi-metallic overload relays provide either manual or automatic reset. Used with a selector switch, the automatic setting on the relay makes restarting fully automatic; used with a push button, it permits the start button to restart the motor without pressing the reset button.

Your G-E Distributor will be glad to give you more information, or write for Bulletin GEA-6198, Section 733-11, General Electric Company, Bloomington, Illinois.

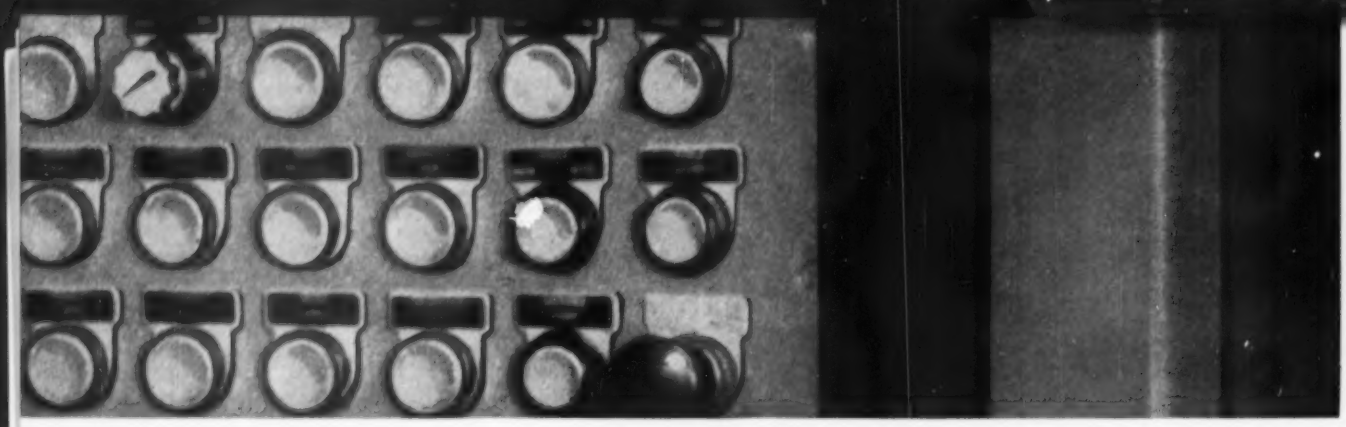
GENERAL ELECTRIC

(1) **CONTACTS** are changed without disturbing wiring. Captive springs on movable contacts prevent loss, assure proper tip pressure.

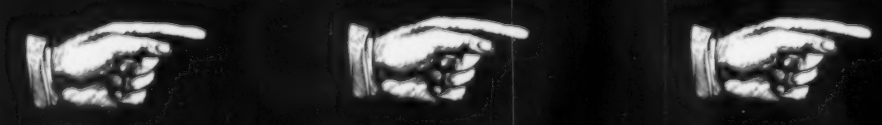
(2) **COIL** change is easy. Just remove 4 screws, lift out the coil and movable magnet. No need to remove the starter from the enclosure.



(3) **OVERLOAD RELAYS** are set for manual or automatic reset simply by moving a spring on the relay from one slot to the other.



PUSH-BUTTON ECONOMY



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Here are a few of the engineering innovations which are strategically important for (1) minimizing operator fatigue and human error (2) speedy change-over and retooling, and (3) push-button simplicity of operation:

In Turret Lathes: Geneva saddles and Hydra-Clutch headstocks; automatic thread chasing; one- or two-way tracing combined with normal Turret Lathe operation; Numerical Tape Control for Automatic Turret Lathe.

In Automatic Lathes: Automatic handling; feed-back; gaging; sorting; chip disposal.

In Grinders: Automatic Tap Grinders; Optical Contour Grinders; automatic handling for Thread and Form Grinders.

These are typical results of our all-out efforts toward machine design that will reduce costs, increase production, and keep both operators and management happy.

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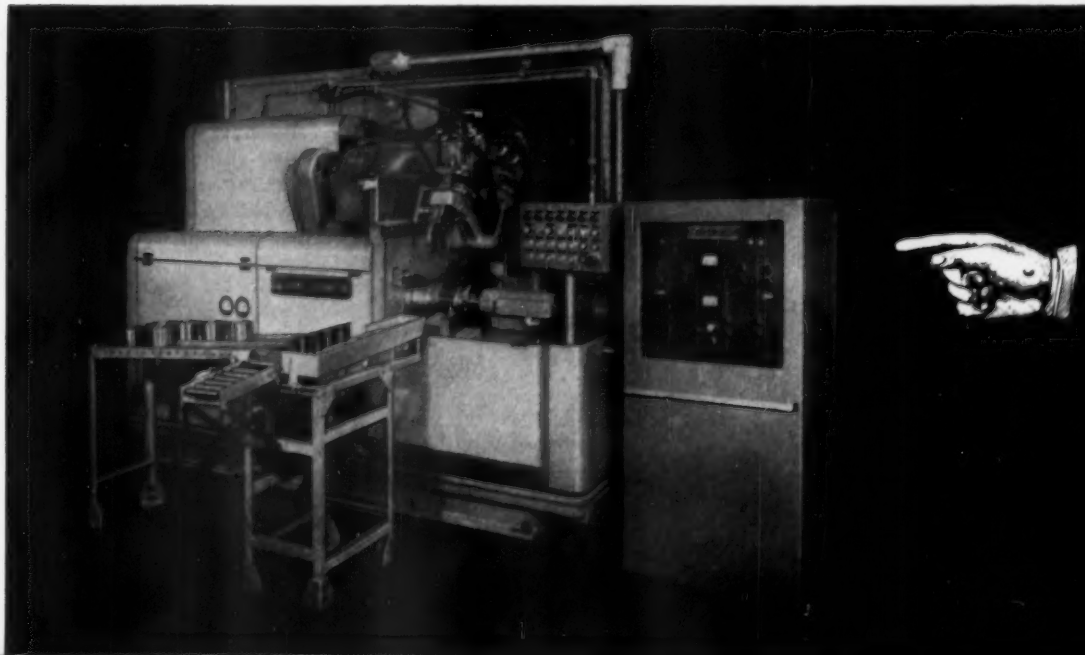

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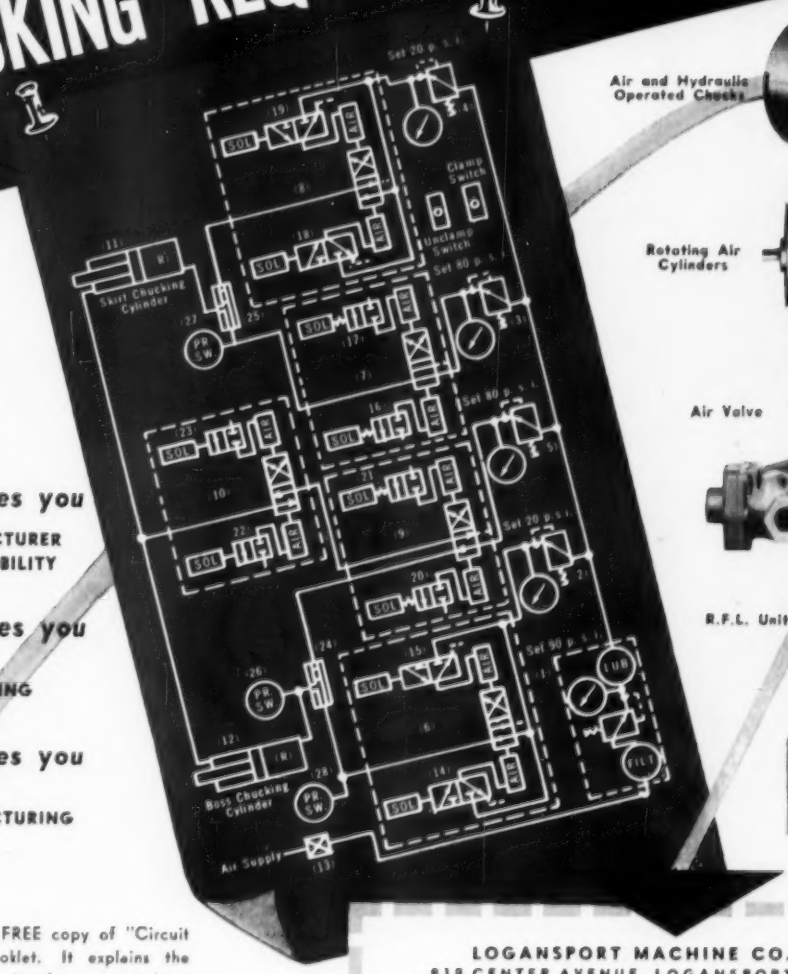

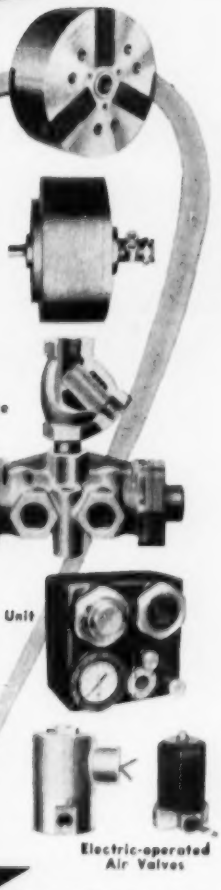

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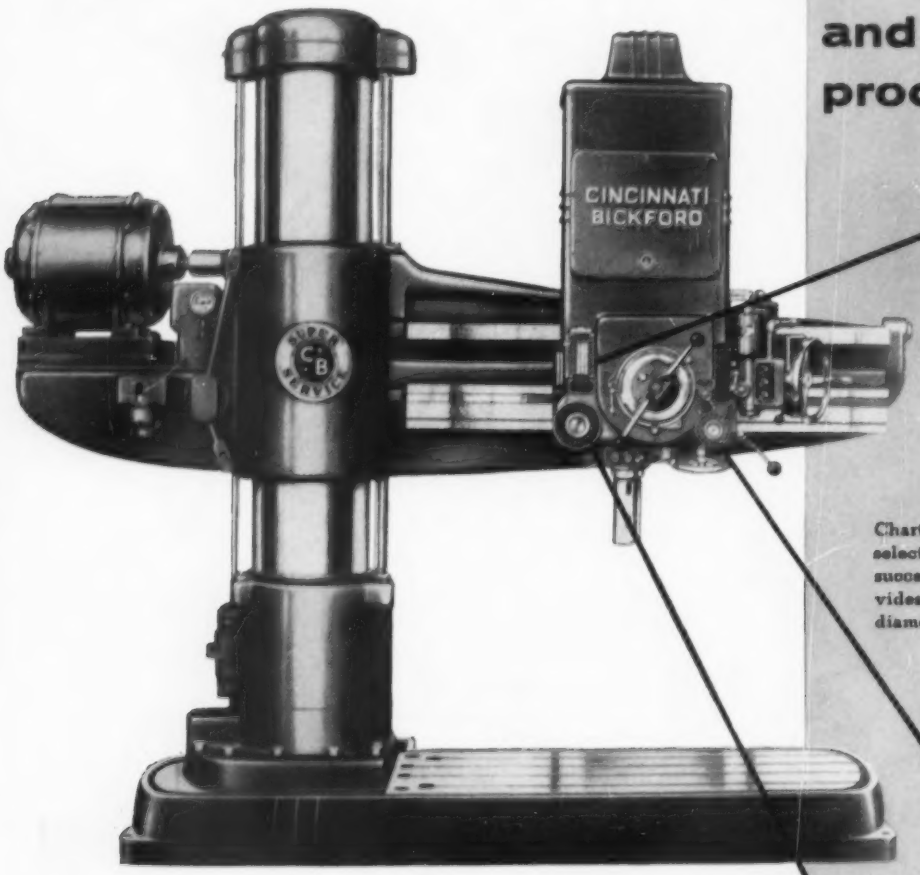

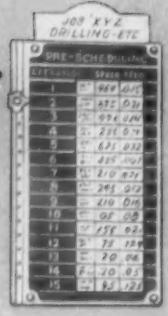

Chart guides the operator in pre-selecting speeds and feeds for succeeding operations. It provides a permanent record of tool diameter, speed and feed.

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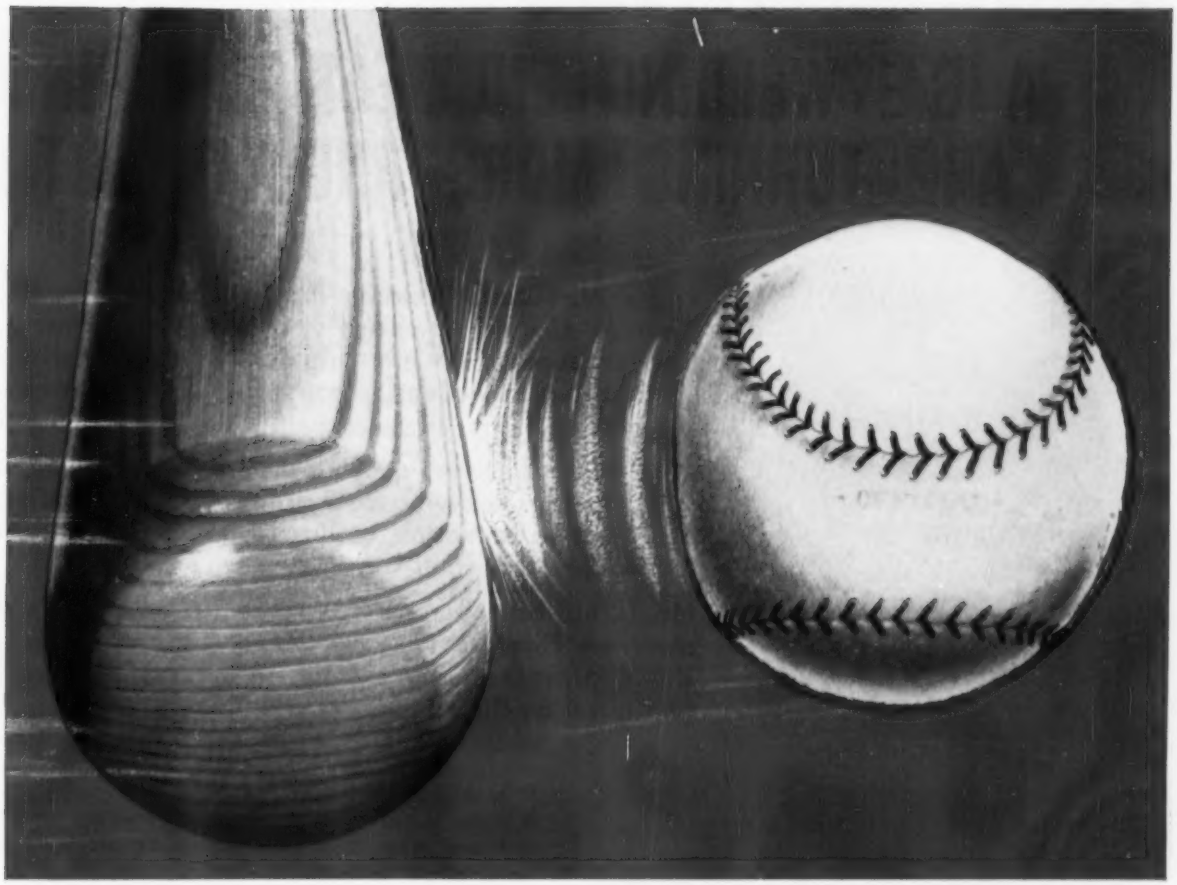

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These modern, superior J&L Leaded free-machining cold finished steels are meeting with outstanding acceptance in machine shops everywhere. They are a star member of the complete line of premium quality, free-cutting cold finished bar steels produced over the years by J&L specialists. Thus, we can recommend the right type to help solve your particular machining problems.

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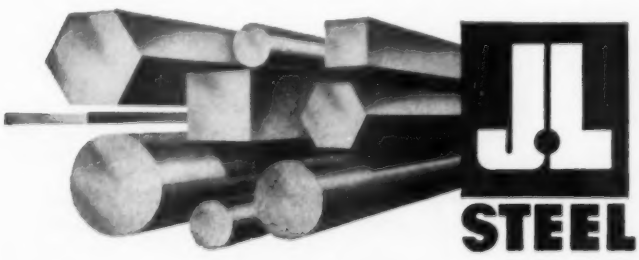

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A Report on Automatic Arc Welding

A G-E WELDING ENGINEER EXPLAINS ARE TURNING MORE AND MORE TO

Roger W. Tuthill, Welding Process Engineer for the General Electric Company's Welding Department, answers some of the more frequently asked questions about the gas-shielded, consumable-electrode welding process.

Mr. Tuthill's answers explain the increased attention this process is receiving from production and welding people as automation begins to make greater demands on production welding.

Mr. Tuthill has been active in research and development on Fillerarc welding, General Electric's gas-shielded process, and has had a number of papers published on the subject.

Q. What is the gas-shielded welding process?

A. Gas-shielded welding is a consumable-electrode arc welding process which uses a reel of bare electrode wire fed mechanically through a welding head. Gas, such as carbon dioxide or argon, flows around the electrode to form a protective shield about the arc.

Q. Is there anything particularly new about gas-shielded arc welding?

A. Yes—if you're talking about ***automatic*** gas-shielded arc welding!

Historically, powdered flux has been used as the shielding agent in automatic arc welding, mainly because no gas process was economically feasible for welding mild steel. However, gas-shielding was attractive to many prospective users because it eliminated the many problems created by the use of flux—expensive flux recovery systems, flux inclusions in welds, flux in the air, more precise fixture requirements, and other difficulties.

Gas-shielding has been used for welding non-ferrous and stainless steels, but the relatively high costs of the inert gases used made gas-shielding impractical for mild steels.

Recently, the successful application of low-cost carbon dioxide as a shielding gas has finally made it economical to use gas-shielded equipment for welding mild steels. For example gas savings of 90% over inert gas costs have been reported. Since by far the most welding being done today is on mild steel, it is easy to see why this development is causing so many production people to turn to automatic gas-shielded arc-welding for answers to their production welding problems.

Q. Does a gas-shielded automatic welding system cost any more than other automatic arc welding systems?

A. The cost of setting up a gas-shielded system is about the same as for a comparable submerged-arc automatic system.

For example, while the ***purchase*** price of gas-shielded automatic equipment may be more than that of a submerged-arc system, the fact that there is no need for installing expensive flux recovery equipment and other cleaning systems with gas-shielded welding easily makes up the purchase price difference.

Q. Does the quality of welding done with gas-shielding compare with other welding processes?

A. Quality of welds made with the gas-shielded automatic welding process compares very favorably with other processes. Since no flux is used there is no possibility of flux inclusions; penetration is usually deeper; and the visible arc permits full control during welding. This visible arc permits less expensive fixtures to be used, an important cost factor in automatic welding.

Q. How about the speed and flexibility of a gas-shielded system? Can it be easily integrated into a production line?

A. A gas-shielded system can be used in production line welding as easily as any automatic welding system.

For example, the G-E Fillerarc system has electrode wire feed speeds which range up to 1000 inches per minute.

WHY FABRICATORS OF MILD STEEL AUTOMATIC GAS-SHIELDED WELDING

The automatic head can be rotated through 360 degrees and can be used for circular or seam welds, and, if necessary, more than one welding head can be used to make multiple welds.

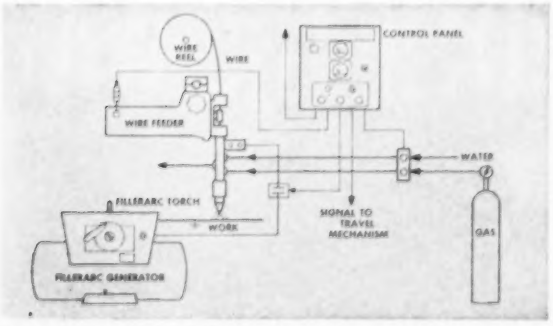
These characteristics make the Fillerarc system flexible and fast enough for almost any production line. Perhaps of equal importance to production people is the system's insensitivity to incoming line voltage, which assures constant production speed and weld quality.

Q. To sum up, what are the really important advantages of the automatic gas-shielded welding process?

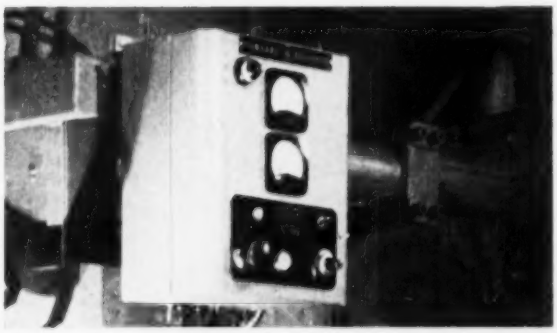
A. In a few words, the most important advantages of the automatic gas-shielded process are flexibility, high welding speeds, uniform weld quality, elimination of the cleaning problems associated with the use of flux, versatility for use with all types of metals, and most important of all, the ability to use low-cost carbon dioxide for shielding.

For more information about Fillerarc automatic gas-shielded welding see your nearby G-E Welding Distributor, or write for Bulletin GEC-1334, Section 713-4, General Electric Company, Schenectady, N. Y.

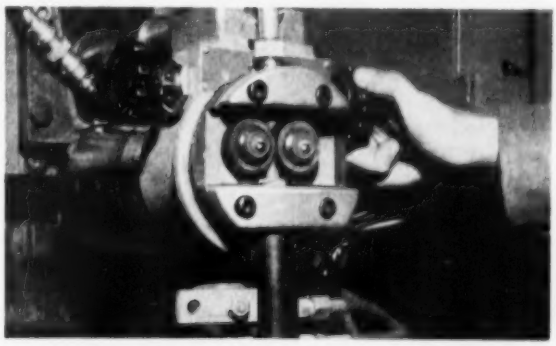
Now, General Electric offers *four* power sources for automatic gas-shielded welding—three new 800-amp rectifier welders and the already-proved 450-amp Fillerarc motor-generator set. They offer a complete choice of output characteristics and automatic features to suit your welding needs.



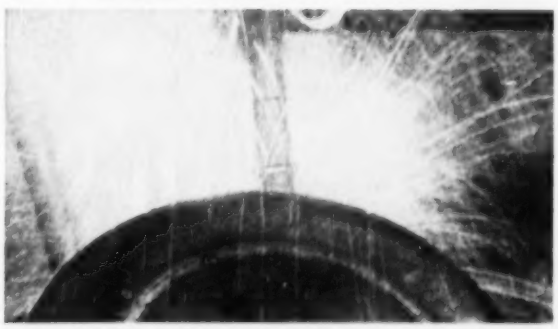
G-E FILLERARC EQUIPMENT is the only complete equipment especially designed for consumable-electrode, gas-shielded welding. Simplicity of the system makes possible use of less expensive fixtures and greater over-all efficiency.



WIDE RANGE OF WIRE-FEED SPEEDS—up to 1000 inches per minute—makes the G-E Fillerarc system flexible enough for any production line. Speed is constant since system is insensitive to normal line-voltage changes.



FLEXIBILITY OF FILLERARC SYSTEM is also demonstrated by the automatic head. It rotates 360 degrees, allowing even overhead welding. Arc is completely visible since gas is used as the shield instead of flux.



CIRCULAR OR SEAM WELDS may be made on stainless steel, copper, aluminum, and other metals—using inert gas. Fillerarc power sources, rectifier or motor-generator, and carbon dioxide combine for low-cost, quality welds on mild steel.

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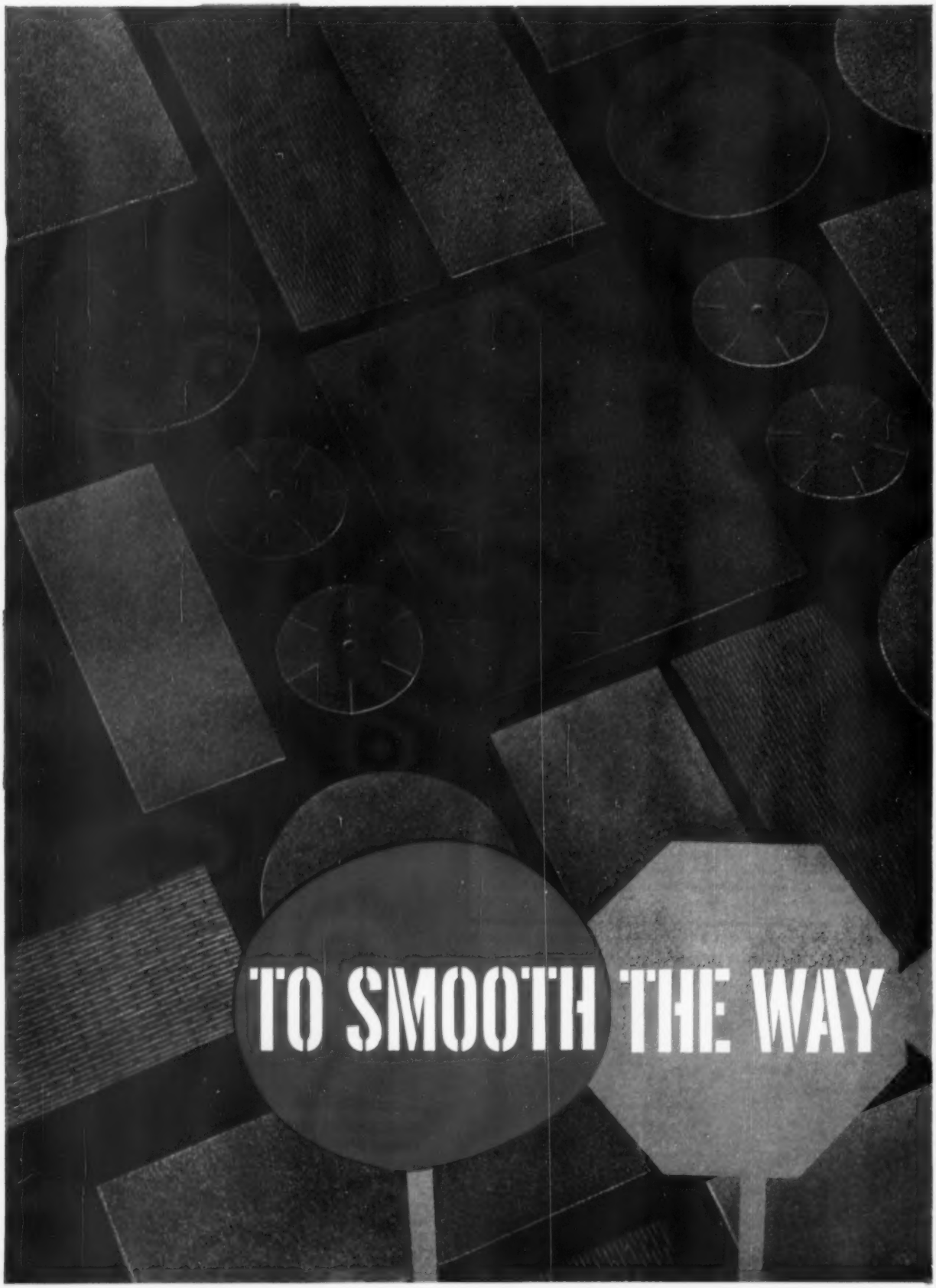

TO SMOOTH THE WAY

JEWEL BRAND ABRASIVES IN SHEETS

JEWEL BRAND Coated Abrasives are stocked in a wide range of standard size sheets. Large inventories of semi-finished materials are maintained from which special sizes may be produced at short notice. Sheets are available in paper backings of A, C, D, and E weights; in cloth backings of jeans or drills; in JEWELITE waterproof paper; and in closed or open coatings. All shipments made in "MASTERPAK" Cartons, a protective type of carton originated by ABRASIVE PRODUCTS, INC.

A COMPLETE LINE OF COATED ABRASIVES

Abrasive Products, Inc., manufactures a complete line of JEWEL BRAND coated abrasive products — belts, rolls, sheets, discs, and specialties in a wide variety of shapes and sizes. It has branch offices and warehouses in New York, Chicago, Cleveland, Pittsburgh, St. Louis, Detroit, High Point, Los Angeles, and Portland, Oregon, to back up distributor and factory service.

"MASTERPAK" CARTON FOR PROTECTION

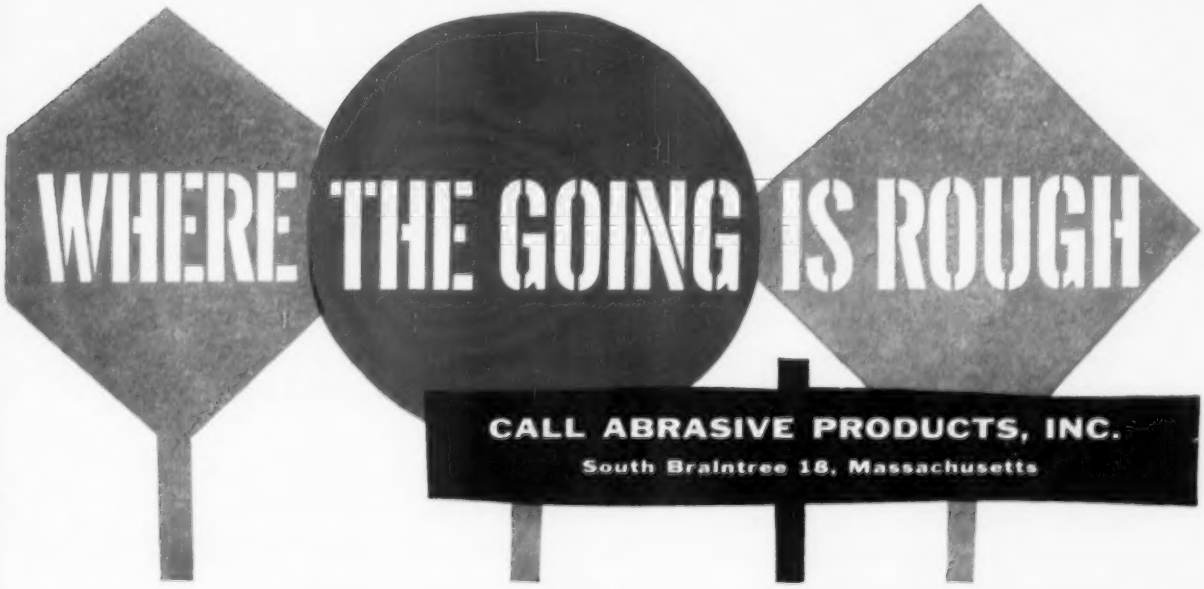
This AP development set the pace for all packaging of coated abrasives throughout industry. It protects shipments in transit by keeping out moisture and other damaging elements — also provides reinforced corners and edges to avoid crushing contents. In the "MASTERPAK" carton JEWEL BRAND abrasives reach you in prime condition, ready to use and the "MASTERPAK" keeps them fresh and clean until the last sheet is gone.

JEWEL BRAND SERVICE

JEWEL BRAND Distributors are located at key industrial centers throughout the country. Backed by AP warehouse service and specialized engineering experience, they are equipped to meet individual needs promptly and efficiently. JEWEL BRAND Distributors and AP Salesmen have one important objective in common — to provide customers with not only the precise coated abrasive for the job, but service "in a class by itself".

JEWEL BRAND
COATED ABRASIVES

JEWELITE • JEWELOX • JEWEL GARNET • NEW PROCESS • JEWEL EMERY • PILGRIM FLINT



A major achievement in

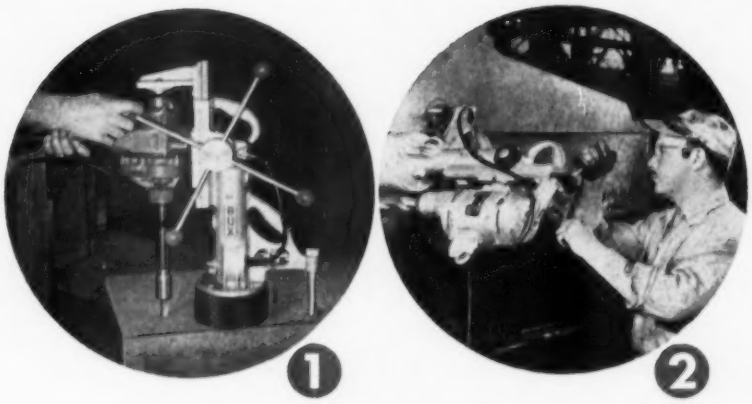
Cuts drilling time
and costs up to 75%
BUX
portable
electro-magnetic drill presses
• Convert your hand drill to a portable precision drill press
• Minimize costly set-up time
• Reduce operator fatigue, increase output
• Simplify drilling on production and repair jobs
BUX

Thousands of applications prove you can now use powerful electro-magnetic forces to hold and position work for drilling. With Bux magnetic drill presses you can convert your air or electric hand drill into a portable precision drill press for shop or field. Compact magnetic base grips work, helps you perform accurate drilling, reaming and tapping in vertical, horizontal and overhead positions!

What holds the work? . . . up to 3 tons of electro-magnetic energy you can control with a flick of the switch! Uses no more power than a 100 watt bulb.

How does it operate? You've seen giant electro-magnetic cranes handling scrap iron. Bux tools apply the same energy principle to the holding and positioning of work.

production or on-the-job drilling!

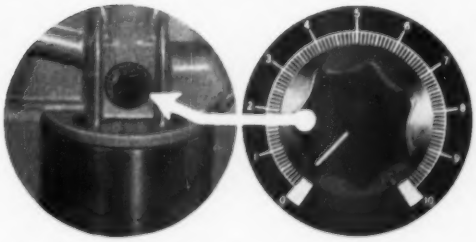


❸ Ideal for drilling workpiece not readily moveable to stationary drill presses.

❷ Drill in any position with accuracy. Power-packed magnet holds drill in place.

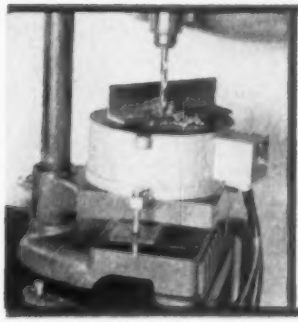
❶ Cut repair time and costs. Drill and tap precision holes with portable Bux drill presses.

A precision drill press you can take to the job!



New! Infinitely variable switch now permits selecting precise magnetic pull needed to hold drill to work while positioning. Permits moving drill quickly, easily.

BUX MAGNETIC PLATE CLAMPS, DRILL VISES



Here's a totally new method for drilling even irregularly shaped ferrous metal that can cut your work time and costs as much as 65%. With a Bux magnetic drill vise, work is securely held with 2,800 pounds magnetic pull—eliminating time-wasting clamps and chucks. The entire vise surface is a powerful magnetic field.

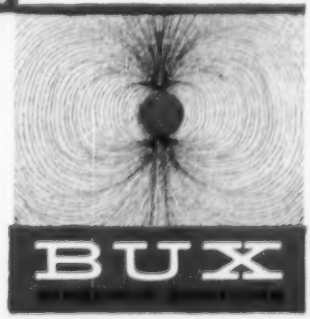
Welders can position work faster, more accurately with Bux portable magnetic plate clamps. No need to wedge, tack or preweld. Up to 6500 pounds of magnetic pull holds work securely while permanent weld is made. Time saved in tacking, welding clamps and deburring cuts welding cost in half.

There's a precision, cost cutting Bux drill press to fit any make portable air or electric drill.

Write for complete details, specifications and prices.

BUCK MFG., CO. 100 ROBERTS RD. • LOS GATOS, CALIFORNIA

3091



GIANT SIZE!

THE GIANT SIZE Sellers Floor Type Horizontal has:

A 10 inch diameter spindle
An 8 foot spindle feeding stroke
A runway that measures 9 feet across the ways
A column that measures 4½ feet across its ways
Up to 15 feet of head travel on the column
A 100 horsepower driving motor

It is a big machine for big work, but with its electronic push-button control, it handles like a small one.

CONSOLIDATED MACHINE

A DIVISION OF FARREL-

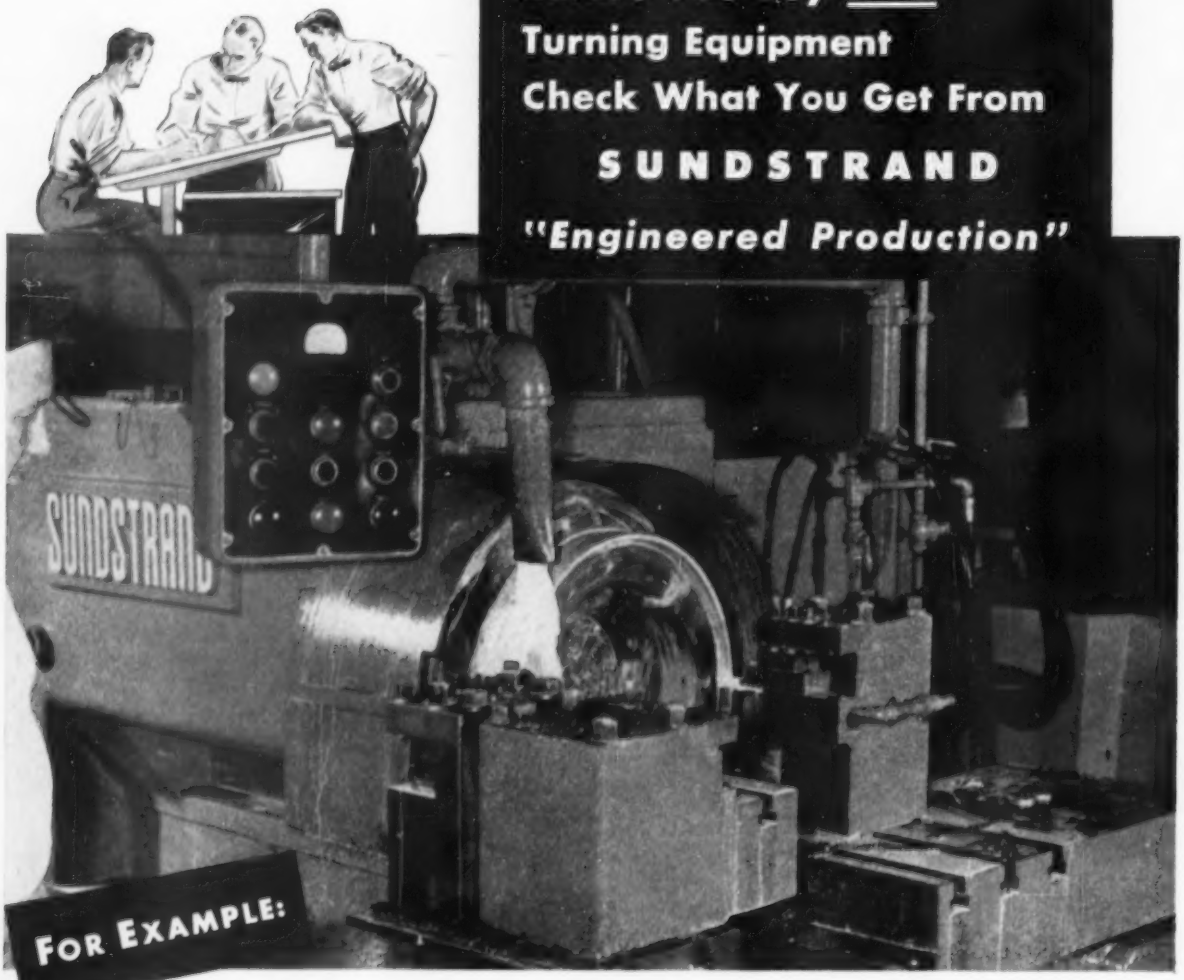
TOOL COMPANY ROCHESTER 10, NEW YORK

BIRMINGHAM CO., INC.

Before You Buy ANY Turning Equipment Check What You Get From

SUNDSTRAND

"Engineered Production"



FOR EXAMPLE:

This Sundstrand Automatic Lathe Increased Production 3 Times

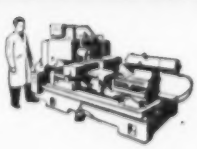
Here's a Sundstrand Model 16 Automatic Lathe that increased production of inner and outer bearing races an average of three times compared to the previous method of machining.

Parts range in size from 9½" to 23⅜" outside diameter and lot sizes vary from 100 to 1000 pieces.

Even though the lot sizes are relatively small the quick set-up and many other features of the Sundstrand Automatic Lathes make it possible to obtain savings like these.

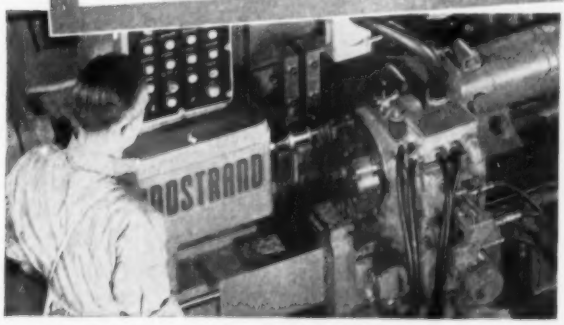
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND *"Engineered Production" Service*



WHY SUNDSTRAND CAN OFFER ECONOMICAL SOLUTIONS TO PRACTICALLY ANY TURNING JOB

Many years of designing machine features to increase production and lower costs on all classes of turning problems has provided Sundstrand with the experience to design and build equipment for practically any turning job. A few of the diversified types of Sundstrand tooling and equipment provided for different turning problems are shown on this page.



Automatic Tool Resetting

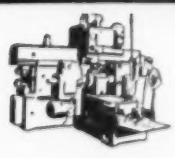
Self compensation for tool wear and automatic replacement of tools worn to a predetermined limit have been built into the Automatic Lathe shown above. Lathe can run approximately an 8 hour shift without attention, except for an occasional check by operator to make sure parts are being delivered to the loading mechanism.

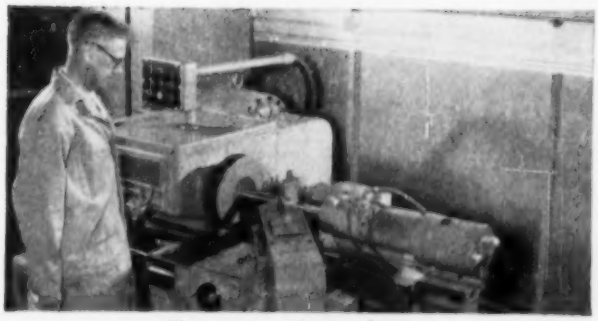
Although the lathe shown above is for turning motor rotors the principle of automatic tool re-setting has been applied to Sundstrand Automatic Lathes for other types of jobs.

How to get the right machine for your work

Investigate the many services and physical equipment available from Sundstrand "Engineered Production." Call in a Sundstrand engineer, or write for bulletin 170. There is no obligation for this service.

TRIPLEX RIGIDMILS | SPECIAL MACHINES



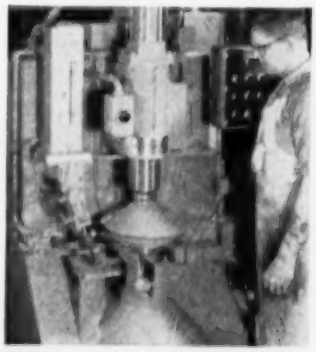


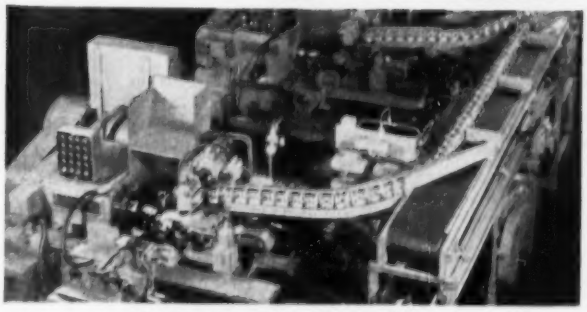
Tracer Turning

For multi-cycle single point turning of irregular shapes, Sundstrand Automatic Lathes can be provided with a template controlled tracing slide that replaces the regular front carriage. With this tracing slide and controls, ruff, semi-finish and finish cuts can be taken with one turning tool in an automatic cycle. The regular rear slide can be used to square up shoulders, chamfer, etc.

Vertical Turning

Here's the Sundstrand Vertical Lathe of a simplified basic design easily adapted to production work. Shown here, it bores, polishes and gages the ID of brake drums. Machine is easily arranged for turning, grooving, or tracer applications.





Automatic Loading

Here's one of the many automatic loading and unloading units designed for Sundstrand Automatic Lathes to handle a specific part. Units of this type simplify machine operation and provide a complete automatic cycle for high production.

SUNDSTRAND
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.

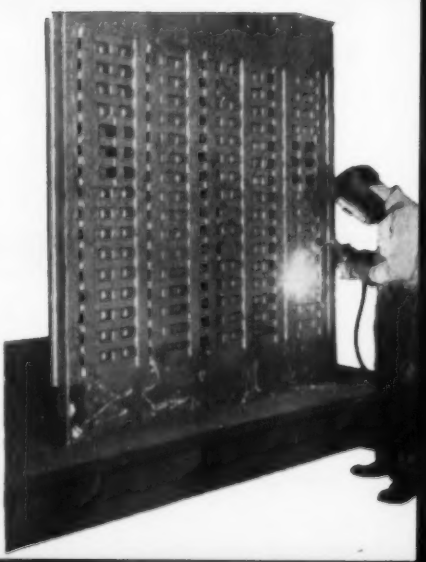
HOW USS "T-1" STEEL IMPROVES THESE PRODUCTS...

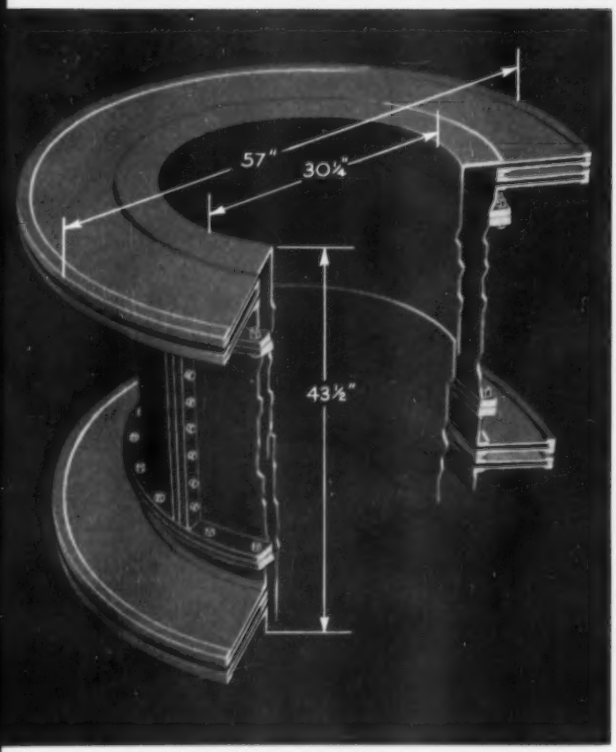
. . . Lops off 1,047 Pounds

Trays for ore clean-up buckets need tremendous resistance to impact, abuse and abrasion. Blaw-Knox Company, Pittsburgh, Pa., found that they weigh half a ton less, and cost less to fabricate when made from USS "T-1" Steel plate instead of heavy steel castings.

. . . 534 Easier Welds

This printing press bedplate, manufactured by Graver Tank & Manufacturing Co., Inc., must be welded in 534 places. High alloy steel with the needed strength was very difficult to weld. But USS "T-1" Steel is easy to weld . . . and has the needed strength to keep these bedplates, used on high-speed printing presses, as lightweight as possible.





. . . Saves $18,043

In structures like this, which are steel bellows that flex up-and-down and sideways, large thermal expansions can be accommodated. These expansion bellows surround struts which support a large axial flow compressor rotor. The bellows are connected from the compressor stator to the foundation. Westinghouse Electric Corporation switched to USS "T-1" Steel . . . promptly cut not only the cost of machining and welding, but also cost of the steel itself—saved $18,043.

. . . Three Ways Better

International Nickel Company of Canada expects USS "T-1" Steel to increase the service life, to reduce the maintenance, and lower the long-term cost of ore cars like this one; because "T-1" Steel has far greater strength, toughness, and resistance to abrasion than steel used previously. The car builder, Canadian Car and Foundry Co., Ltd., has had no difficulty fabricating this very strong alloy steel.

HOW USS "T-1" STEEL CAN HELP YOU

The great strength and toughness of USS "T-1" Steel (90,000 psi. minimum yield strength) helps you to increase the capacity and durability of power shovel buckets and storage tanks without increasing weight.

Its excellent weldability enables you to fabricate large equipment out in the field without heat treatment . . . thus, reduces fabricating and shipping costs and speeds up construction.

Its unusual toughness at sub-zero temperatures helps you to lengthen service life of equipment that must take impact, abrasion, and abuse in all weather.

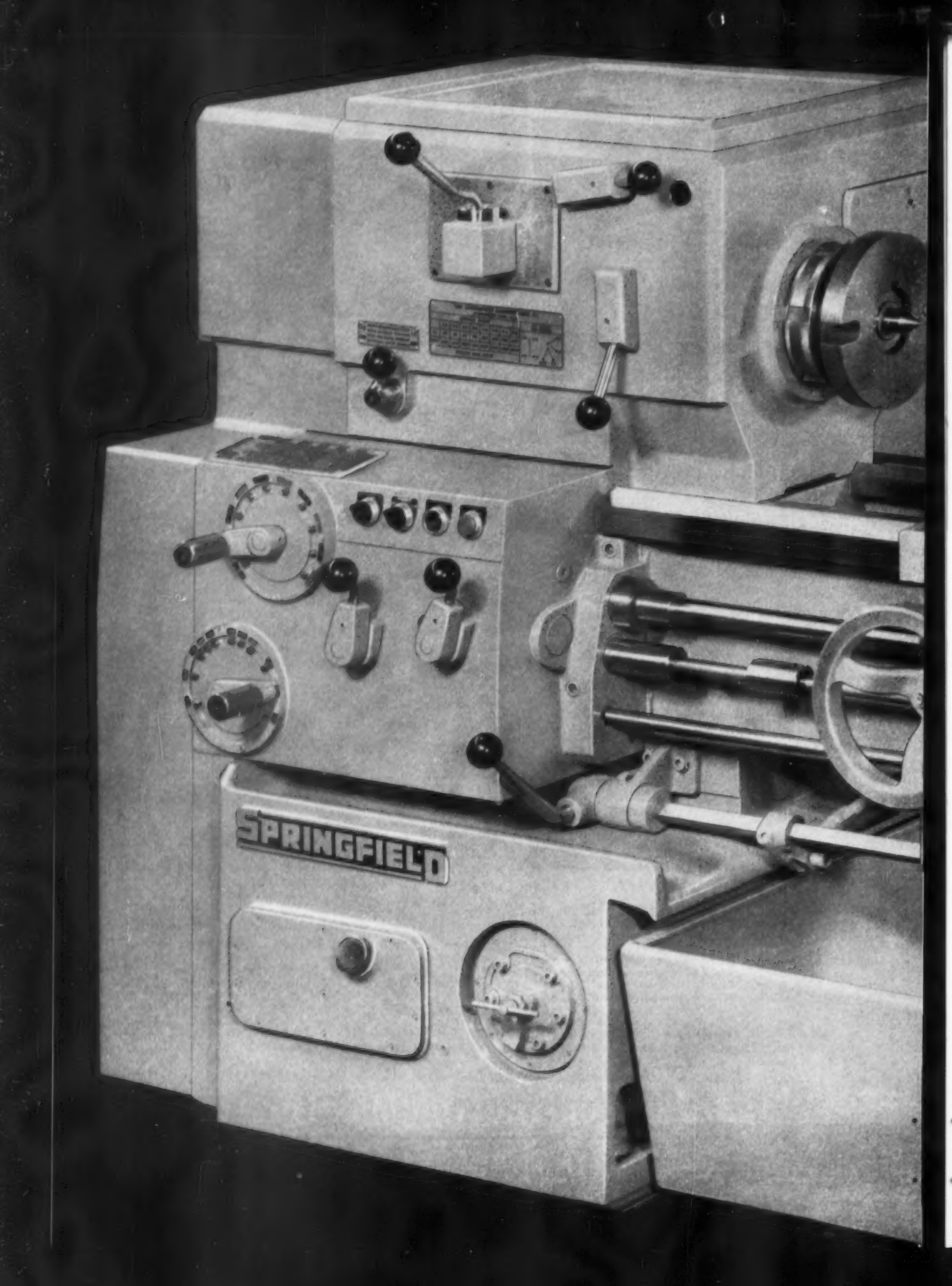
USS "T-1" Steel also gives you good creep rupture strength to 900° F. It often can be substituted for more expensive steels that are more difficult to fabricate. There is a place for "T-1" Steel somewhere in your designs. Write, wire, or phone for more information. United States Steel, Room 5470, Pittsburgh 30, Pa.

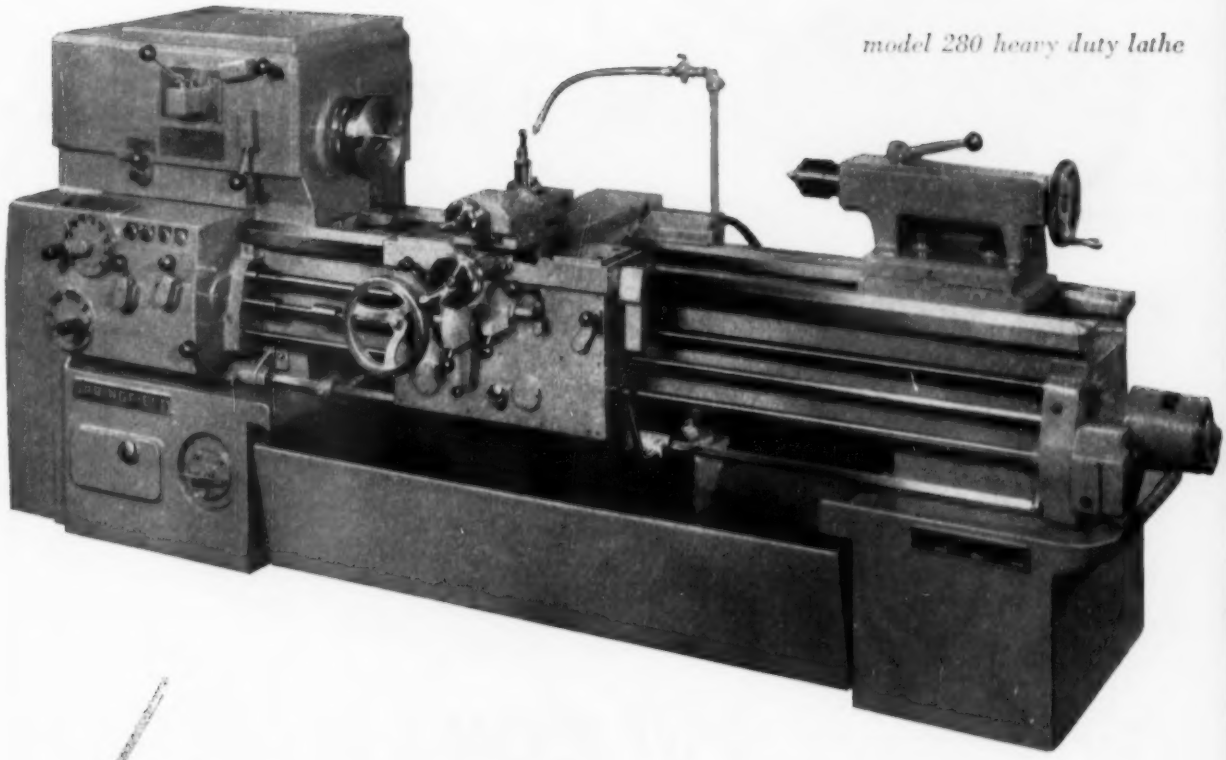
UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS "T-1" CONSTRUCTIONAL ALLOY STEEL

USS

UNITED STATES STEEL


SPRINGFIELD



model 280 heavy duty lathe

it does more work for less money

Springfield is proud to present a new heavy-duty 16" engine lathe, the Model 280. It offers high horsepower—10, 15 or 20 hp—for heavy cuts, clean design, and ease of operation, all at a reasonable price. Direct simplicity and straightforward design assure low maintenance cost.

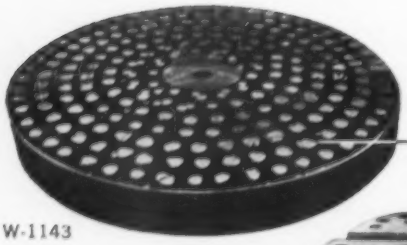
It has no electronic brain, because Springfield believes that most of today's jobs still require craftsmanship of the human variety. In the Model 280 the price is for the tool, not the brain.

Only the gears necessary for a given speed are in mesh. Sixteen speeds to choose from, 60 feeds and threads—available instantly to any operator. Unique sealed oil spray lubricates and cools gears. It's the lathe most easily converted to contouring and reproducing with accessories, without budget strain. If you're in the quality market for a new heavy-duty lathe that still respects the contribution of craftsmanship, the Model 280 is for you. Basic price FOB Springfield, Ohio, $8,013.

The Springfield Machine Tool Company
Springfield, Ohio

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

SPRINGFIELD

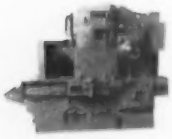


W-1143

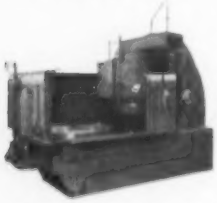
tiny or **tremendous...**

W-1145

For best results...***PUT IT ON A BLANCHARD!***



Blanchard No. 18



Blanchard No. 42-84

There's a Blanchard for every surface grinding job, in a broad range of sizes. For example, the Blanchard No. 18 grinds non-magnetic transistor elements (upper left) .006" thick, to a tolerance of .0005" with good finish. This job, which involved .006" to .008" stock removal per side, was held on special fixture plates.

At the other end of the scale, a huge Blanchard No. 42-84 Grinder grinds a turbine housing (upper right) which measures 83" across the corners, and is 28" high. This housing, ground after rough machining, required .020" stock removal. Both this piece and its mating part were ground to a steam-tight joint.

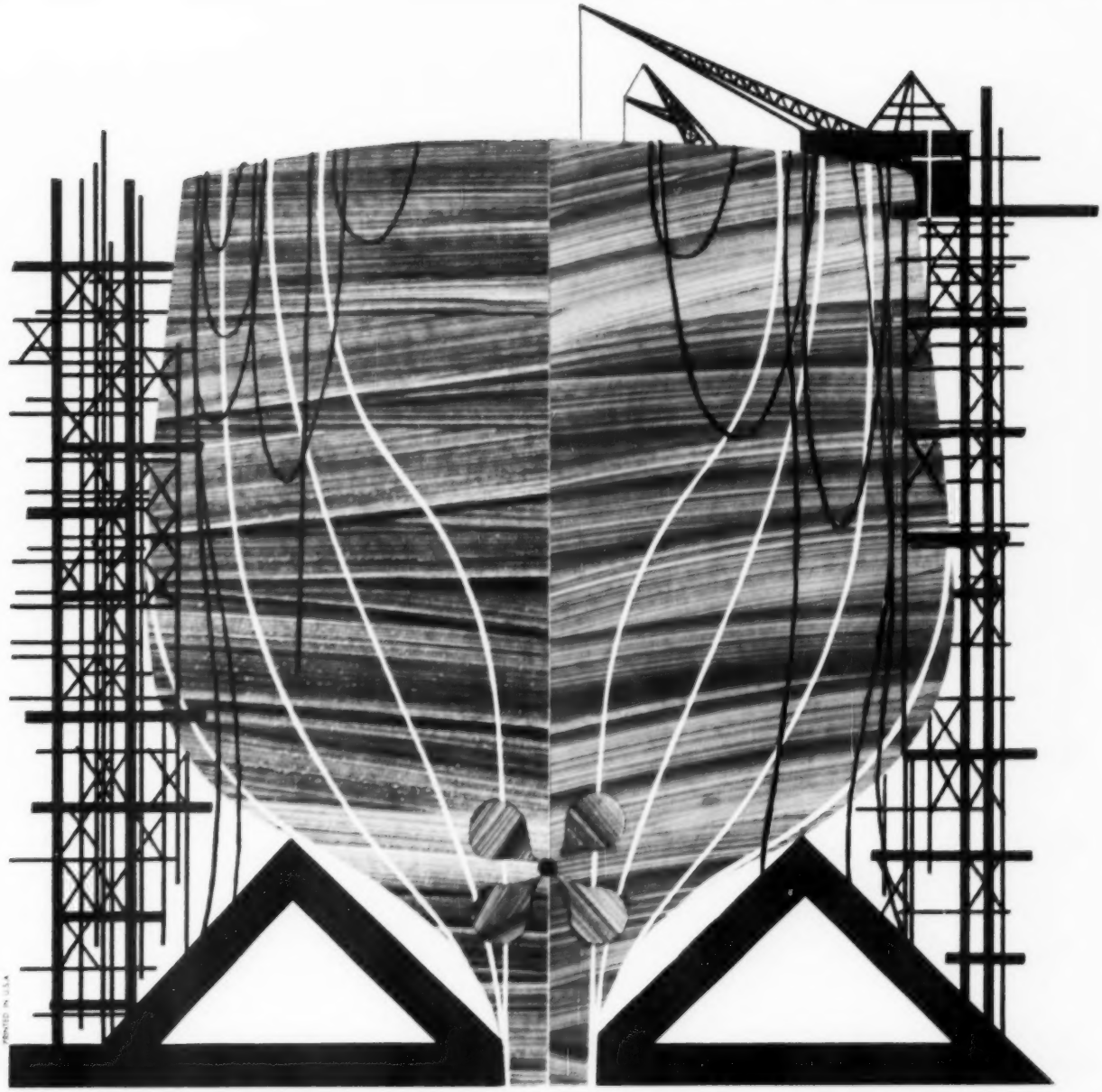
Whatever *you're* grinding—be it tiny watch parts, giant steel plates, or anything in between—there's a Blanchard designed to do the job speedily and accurately.

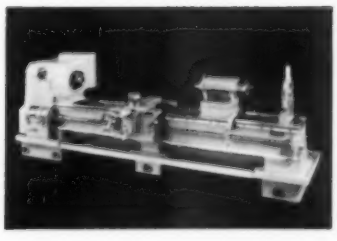
Ask for details on the 15 standard Blanchard models.

PUT IT ON THE BLANCHARD

Send for free copies of "Work done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.





Machines shown are Cincinnati's new 21" Stationary Head Drill and 26" Tray-Top Lathe.

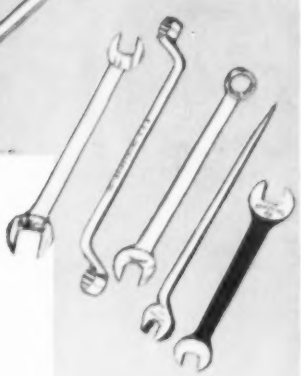
SHIPBUILDERS and ORDNANCE manufacturers are dynamically attacking "old age" among their 43,000 drilling machines and 55,000 lathes.* They recognize the problems of forging the arms of preparedness with half their machine tools of World War II vintage. This is the picture of *all* our country's production. It comforts the forces that would destroy us. It pleases your competition. Yet modernization is quick and inexpensive with "Standard Machine Tools" developed against fresh, new concepts of appearance, function and accuracy. To this end, Cincinnati Lathes and Drills are built to do much of your jobbing, tooling, maintenance and light production work at tremendous savings. Write for complete catalog information. Cincinnati Lathe and Tool Co., 3247 Disney, Cincinnati 9, Ohio.

*Figures from American Machinist's Seventh Inventory.

center on... **cincinnati lathes and drills**

ARMSTRONG

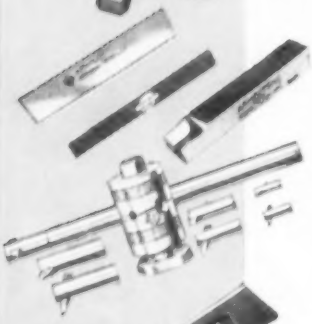
Quality TOOLS

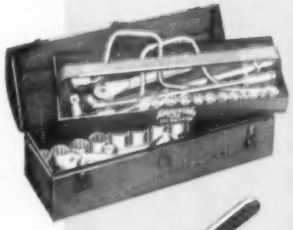


More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

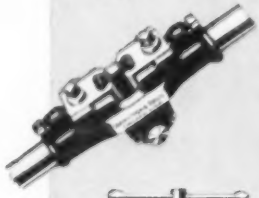
TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

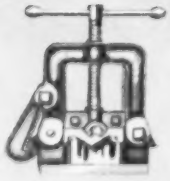




STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.





ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 WEST ARMSTRONG AVE. • CHICAGO 30, ILLINOIS

Colored stripes that roll on dry!

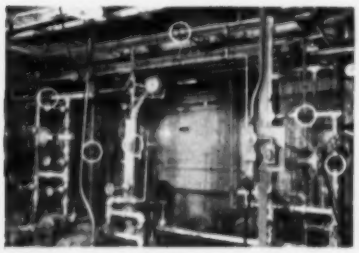
Whether it is coding pipelines, marking danger zones, or sealing containers, "Scotch" Brand Plastic Tape in *colors* does it faster, easier, cheaper. Tough, long-wearing tape resists acids, alkalies, greases, salts, most solvents. Eight colors: red, green, black, orange, blue, yellow, white, brown—a variety of widths. Ask your regular tape distributor for a demonstration, or send for folder described at right. Always specify "Scotch" Brand, the *quality* tape . . . and *stick with it!*

PLASTIC TAPE . . . *one of more than 300 pressure-sensitive tapes for industry, trademarked . . .*

REG. U.S. PAT. OFF.

SCOTCH BRAND

Look what you can do with it!



CODE pipes, fluid lines, electrical systems, etc., to simplify production and servicing with colored bands of "Scotch" Brand Plastic Tape No. 471. Variety of colors and widths permits hundreds of combinations.

DEFINE traffic lanes, indicate storage areas, set off production zones with floor stripes of "Scotch" Brand Plastic Tape No. 471. Tape adheres to concrete, wood, metal, painted, or composition surfaces.

MARK obstacles, danger points, special equipment with patterns of "Scotch" Brand Plastic Tape. Tape stripes need no drying time; colors may be combined into any patterns.

SEND FOR FREE FOLDER showing how you can use "Scotch" Brand Plastic Tape in your plant. Just write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. MA-86.

The term "Scotch" is a registered trademark of Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. Export Sales Office: 99 Park Ave., New York 16, N.Y. In Canada: P.O. Box 757, London, Ontario. © 3M Co., 1956

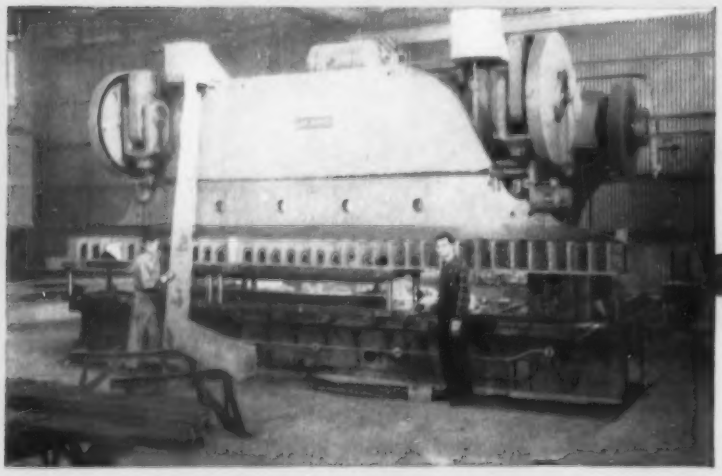
70 minutes cut

on combined blanking and punching operations!

—FORT WAYNE STRUCTURAL STEEL CO., Inc.
Fort Wayne, Ind.

This versatile Cincinnati All-Steel Press Brake, 34 Series x 16′, has revolutionized the production of these long motor truck side rail reinforcements.

Check with our die engineering department on the application of a versatile Cincinnati All-Steel Press Brake in your shop. It can sharply reduce your production costs.



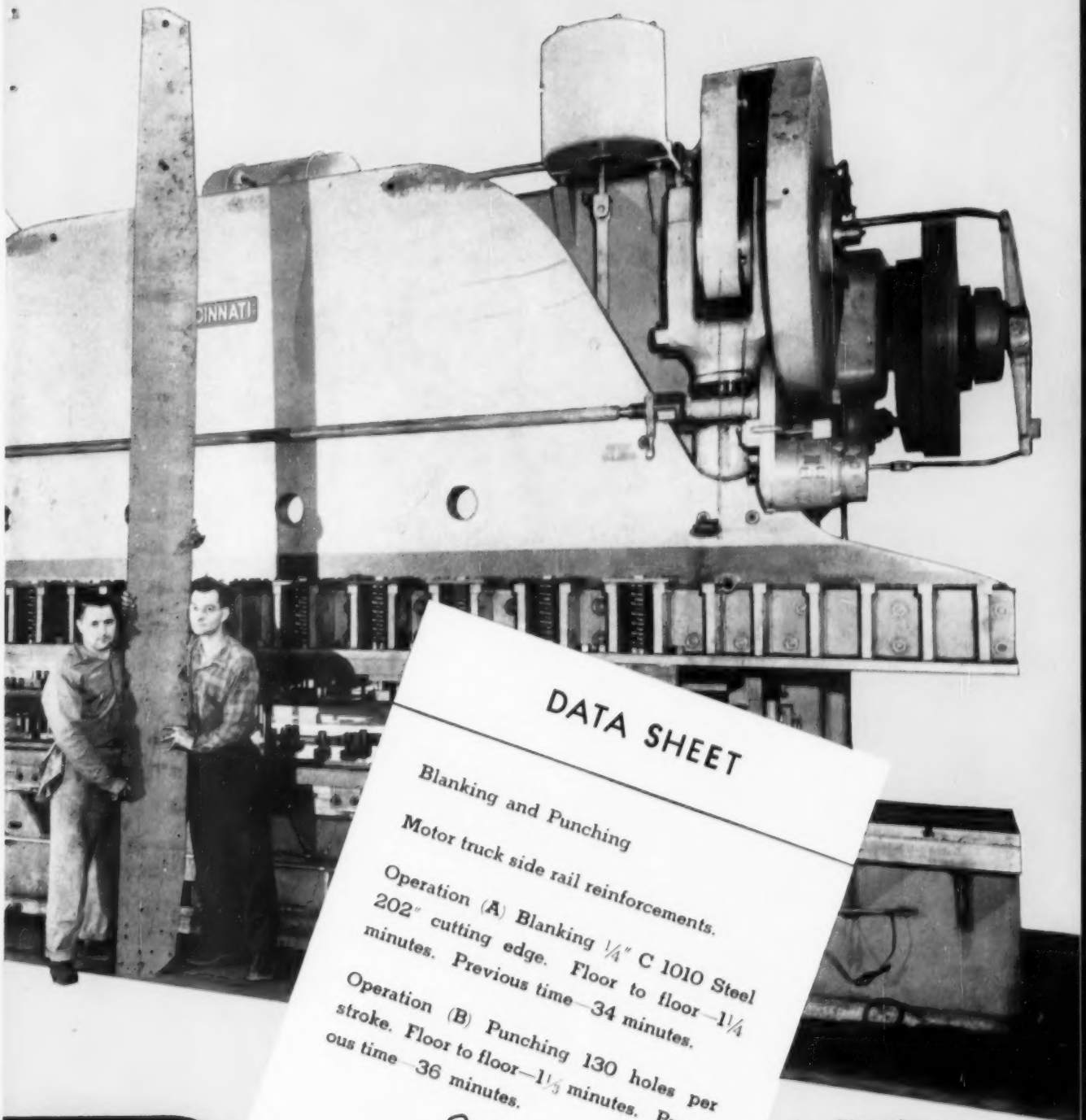
(A) Blanking floor to floor time 1¼ minutes. Previous time 34 minutes.

(B) Note Fort Wayne's ingenious punching equipment which reduced punching time from 36 minutes to 1⅓ minutes and took advantage of every versatile Cincinnati feature.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

to 2.6 minutes...



DATA SHEET

Blanking and Punching

Motor truck side rail reinforcements.

Operation (A) Blanking ¼" C 1010 Steel 202" cutting edge. Floor to floor—1¼ minutes. Previous time—34 minutes.

Operation (B) Punching 130 holes per stroke. Floor to floor—1⅓ minutes. Previous time—36 minutes.

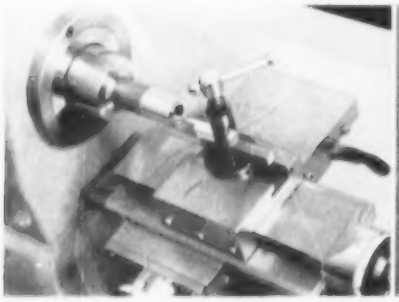
John L. Hayner
President

Photos Courtesy—
FORT WAYNE STRUCTURAL STEEL CO., Inc.
Fort Wayne, Indiana

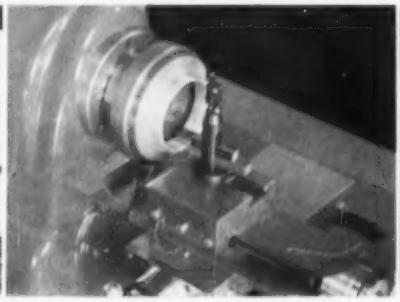
HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

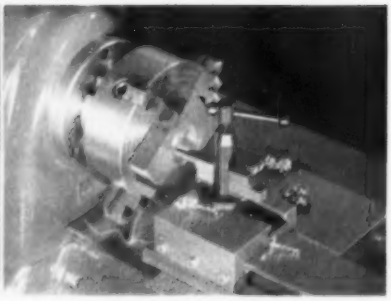
Correct Size - High Speed - Precision Results



Collet Work — The right machine for collet work of 1-1/16" or less diameter.



Step Chuck Work — For rapid and accurate holding of tubing, castings, moldings, stampings and machined parts. Capacity to 6".



Jaw Chuck Work—Integral mount, universal or independent, for extra accuracy. Capacity to 5".

SPECIFICATIONS:
1 1/16" Collet Capacity
9" Swing
17" Center Distance
Infinitely Variable Speed
230—3500 r.p.m.

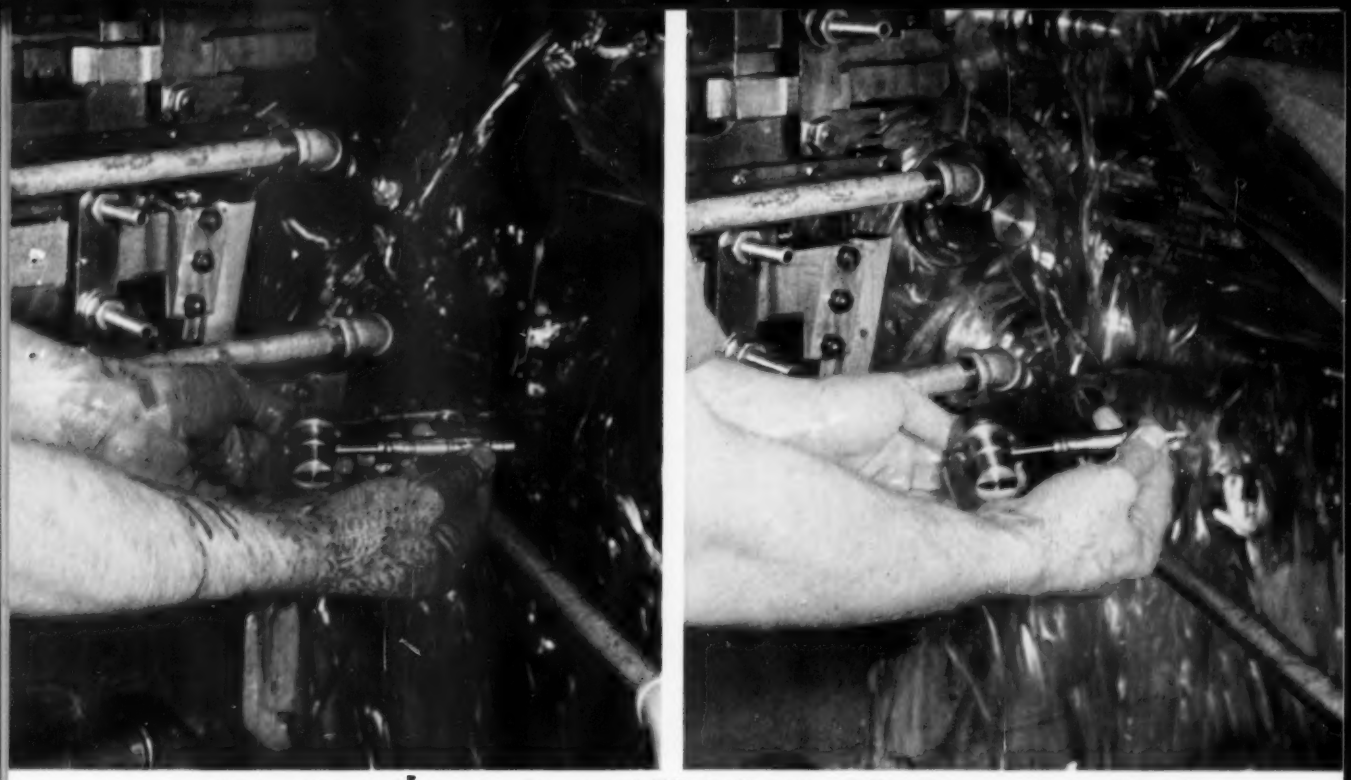
The above three important requirements for proper lathe work in tool rooms, production departments, or laboratories are completely fulfilled by the new Hardinge DV59 High Speed Precision Lathe.

Correct size of the machine in relation to work saves loss from under-capacity production on larger lathes. High spindle speeds, up to 3500 r.p.m., permit full capacity cutting and excellent finish. Sustained accuracy and ease of operation assure precision results

Send for Free illustrated Bulletin DV 59

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 268 Lafayette St., New York 12, N. Y.



Black cutting oil (left) makes close control difficult. Operators dislike dirty operating conditions it creates. Close control is easier and workers are happier with transparent Sunicut cutting oil (right).

WHY USE A BLACK CUTTING OIL WHEN YOU DON'T NEED IT?

Sunicut oils give you better visibility without sacrificing machining efficiency.

When trying to maintain close control over machines producing precision parts, operators can be handicapped by "black-oil blindness". It is hard to see the tools, the workpiece, and the finishes. Checking close tolerances is difficult when the graduations on micrometers and gauges are obscured.

Worse still, as the operator sees it, are the dirty working conditions caused by dark oils. His clothes get saturated with hard-to-remove stains, and his hands are black from one end of the shift to the other.

Transparent Sunicut oils help keep your operators happy and will make close control easier ...and transparent Sunicut oils will do the job with no sacrifice in machining speed or finishes.

To get the full story on Sunicut oils, see your local Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-41.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

For any machining or grinding operation . . .

THERE'S A SUN OIL THAT'LL GIVE YOU HIGH EFFICIENCY AND LOW OVER-ALL COST

No two machine shops have exactly the same problems when it comes to selecting cutting oils . . . even when they're running the same job. And, until somebody comes up with the truly universal cutting oil, you can't afford to disregard the importance of oil selection. Here's how Sun can help you.

First, Sun makes a complete line of emulsifying and straight cutting and grinding oils. Second, your Sun representative, backed up by field engineers, has the necessary practical experience to recommend the oil that will give you both high machining efficiency and low over-all costs.

For the full story about Sun's cutting oils, see your Sun representative . . . or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. I-42.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

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IN CANADA: SUN OIL COMPANY LIMITED, TORONTO AND MONTREAL

new Carlton pre-selector

One of 3 different speed-feed controls for Carlton radial drills

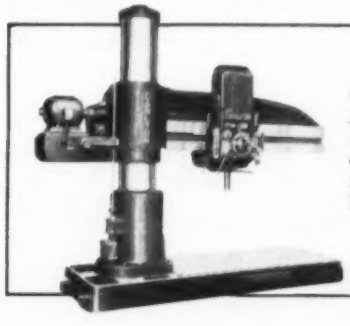
The new Carlton-Leber speed-feed pre-selector system speeds up drilling by permitting operator to set speed and feed for the next operation while the machine is still under cut. With this productive new device, the time lost heretofore in setting speeds and feeds is now used for almost continuous drilling. Now you stop the spindle only for changing cutting tools.

Additional time is saved by instantaneous gear shifting made possible by mechanically oscillating the change gears which assures quiet gear mesh.

Programming—another Carlton-Leber system used in connection with the pre-selector. Pre-selects speeds and feeds for as many as 20 or 30 operations in an entire drilling program.

Manual Gear Shift: 2 shift levers for controlling speeds, 2 for feeds . . . select speed-feed combinations manually, one at a time.

Write for descriptive bulletin giving complete information. The Carlton Machine Tool Co., Cincinnati 25, Ohio, U.S.A.

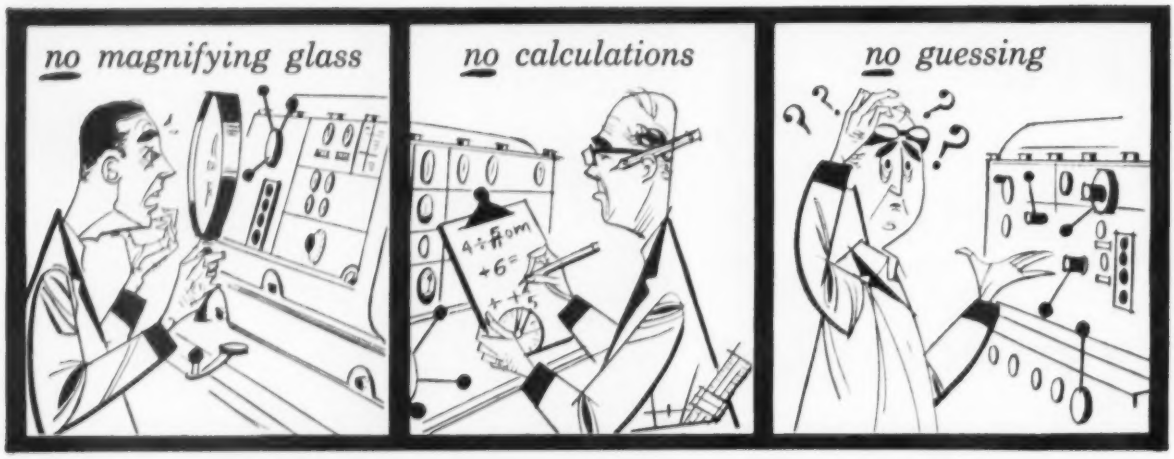


Check Carlton Arm lengths 3-ft to 12-ft, column diameters 9″ to 26″. 4H and 5H horizontals

Carlton

horizontal and radial drills

Know your feed... set your speed!

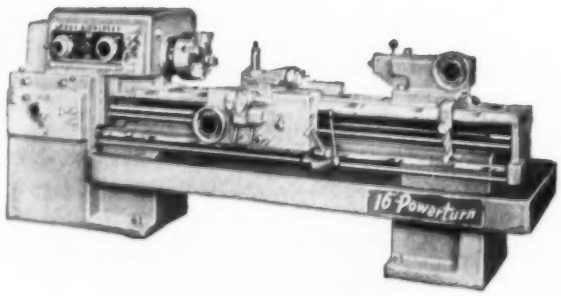


quickly . . . almost automatically with the LODGE & SHIPLEY *Powerturn* LATHE and SPEED-DIAL HEAD!

Take "by-guess" and "by-golly" confusion out of lathe operation! Lodge & Shipley POWERTURN Lathes with *Speed-Dial* Head make speed selection and setting simple as **a...b...c!**

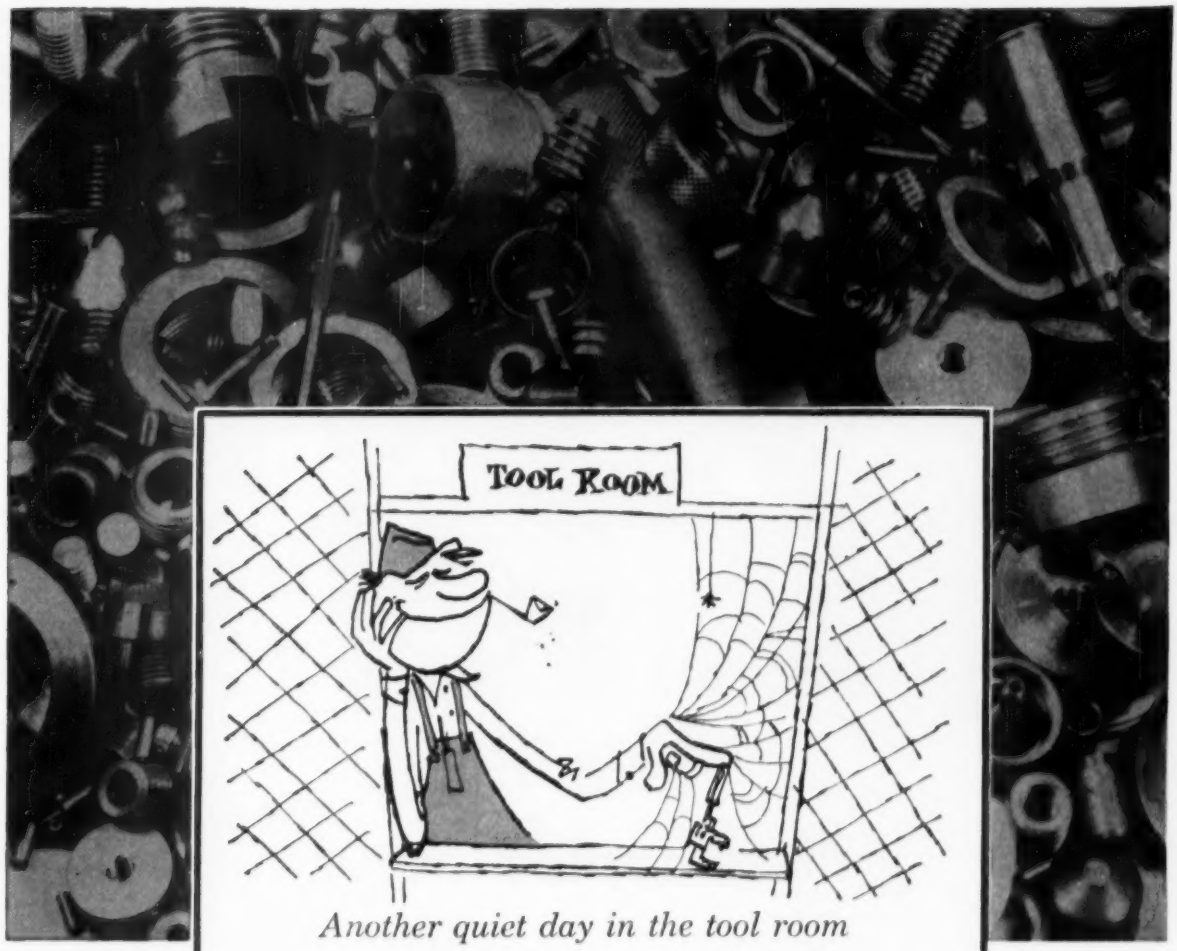
a . . . set work diameter
b . . . read r.p.m. opposite cutting speed
c . . . set levers to automatic indicator lights

This time-saving, fool-proof simplicity is but one feature of New POWERTURN Lathes. Combined with traditional Lodge & Shipley accuracy and rugged strength are many other features for new precision and new operating convenience. New literature . . . ready now . . . tells the complete story: how POWERTURN Lathes are designed to facilitate turning to higher levels of profitable operation, 13, 16 and 20-inch sizes; Engine, Toolmaker and Gap types plus famous COPYMATIC with both 45° and 90° tool slides. **The Lodge & Shipley Company, 3055 Colerain Ave., Cincinnati 25, Ohio.**



Lodge & Shipley

your LODGE-*ical choice!*



Another quiet day in the tool room
. . . they're doing the job with MX

USS FREE-MACHINING MX STEEL works *with* your tools, not against them. That's because USS MX has been specifically designed to ensure maximum cutting speeds compatible with economical tool life — and it does exactly that.

As a result, in the hundreds of shops that have put MX to work, tools have lasted up to 200% longer. Cutting speeds have increased as much as 50%. Output has been boosted an average of 40%.

USS MX has so consistently outperformed ordinary screw stock that we can tell you with complete confidence that *MX will cut the cost of any part* you now machine from regular Bessemer grades. What's more, the parts you make will be *better* parts—more accurate, of better finish. Rejects will be fewer.

And here's another reason why MX is your best buy today. Despite the fact that it *costs no more than ordinary screw stock*, USS MX has been successfully machined at speeds approaching 350 SFM — speeds far higher than the average (under 250 SFM) used in most shops today.

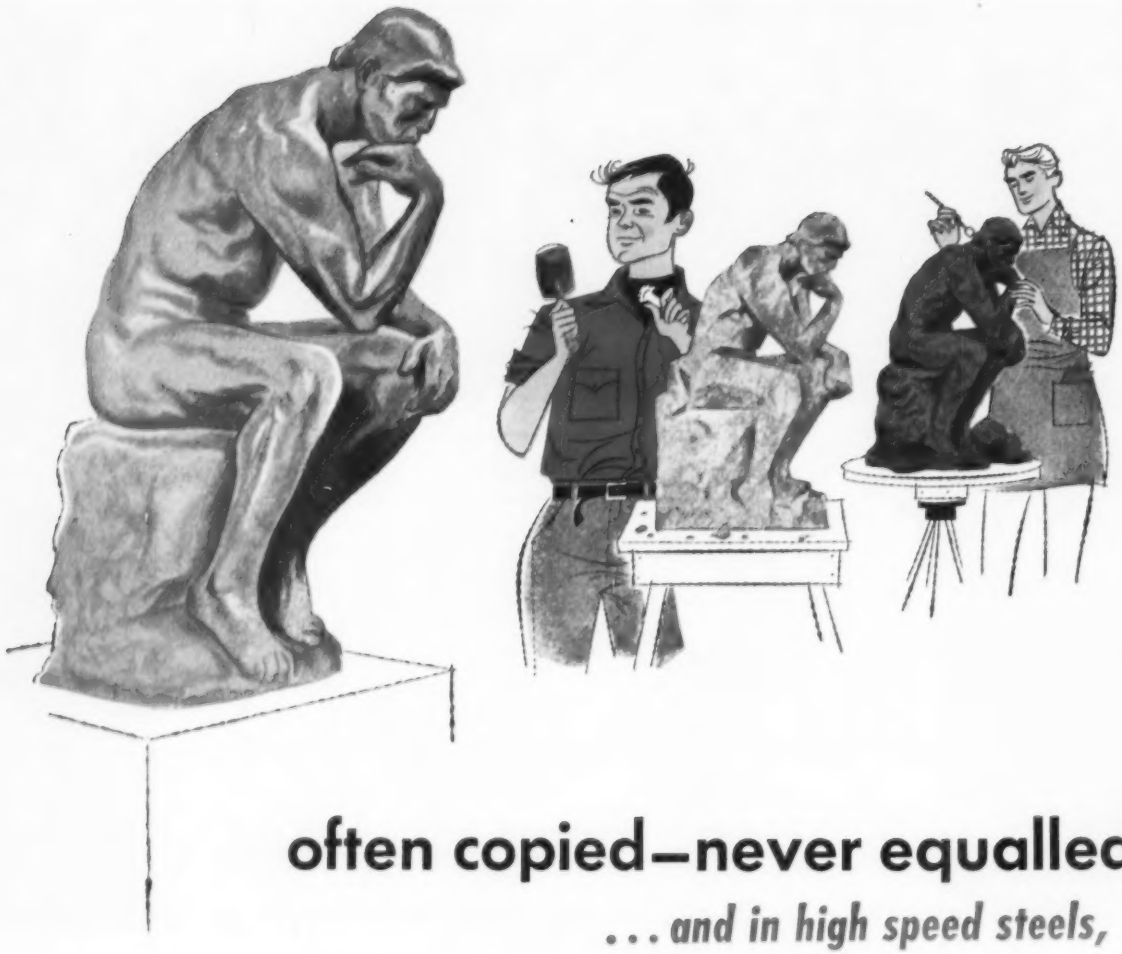
Available in both Bessemer and Open Hearth grades, USS Free-Machining MX Steel is produced in all the popular screw stock sizes. It is sold in cold finished form by your regular supplier, either as "MX" or under his identifying trade name. In hot-rolled form, MX is available through our nearest sales office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Longer tool life . . . bigger output . . . lower costs
—when you do the job with free-machining MX

USS

UNITED STATES STEEL



often copied—never equalled

...and in high speed steels, nothing has ever equalled REX

Crucible's REX® high speed steel is in a class by itself—has been for more than half a century. And it gets better every year. New improvements in manufacturing techniques have brought even greater uniformity and quality to its well-known properties.

But prove this for yourself—shop-test the new REX in your own plant. Check its structure, uniformity, response to heat-treatment—all-around tool performance. Try REX any way you like—you'll see for yourself why the new REX is still the *standard for comparison* in every high speed steel application.

You can get REX from stock from your nearby Crucible warehouse—or promptly by direct mill delivery. For further information on REX and the many other Crucible special purpose steels, send for the *Crucible Publication Catalog*—it's yours for the asking. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

CLEEREMAN

DRILLING MACHINES

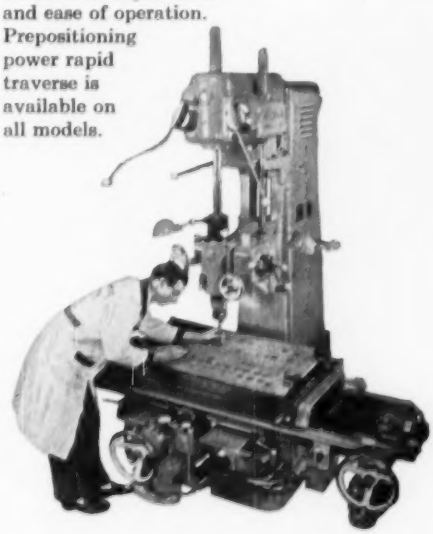
A battery of box column and round column Cleereman Drilling Machines on production work. One of many such installations producing at lower costs with higher production, less operator fatigue and no down time.

LAYOUT DRILLING MACHINE

A modern solution to an old problem. Built for those tool room and manufacturing jobs which do not require the ultra precision of Cleereman Jig Borers. The Cleereman Layout Machine is an economical machine capable of locating within .001" per foot and drilling, boring, reaming, tapping, etc., with utmost operator ease at a fast rate of production.

JIG BORER

Unexcelled precision for ultra-fine tolerances on highest quality gage, tool, die, jig and fixture work and on "jigless" production. Combines stamina with precision and ease of operation. Prepositioning power rapid traverse is available on all models.



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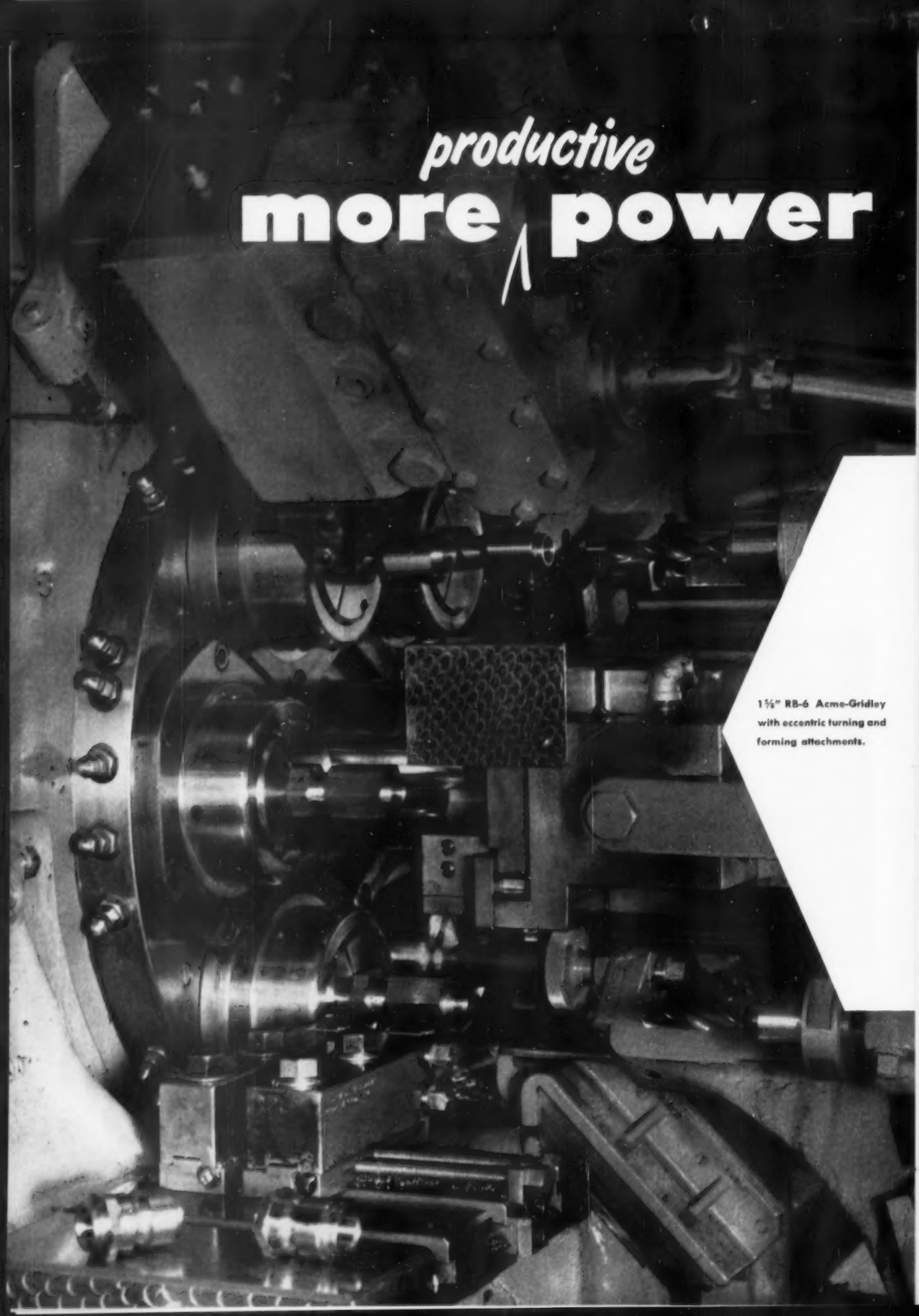
CLEEREMAN MACHINE TOOL CORP., Green Bay, Wis.

productive

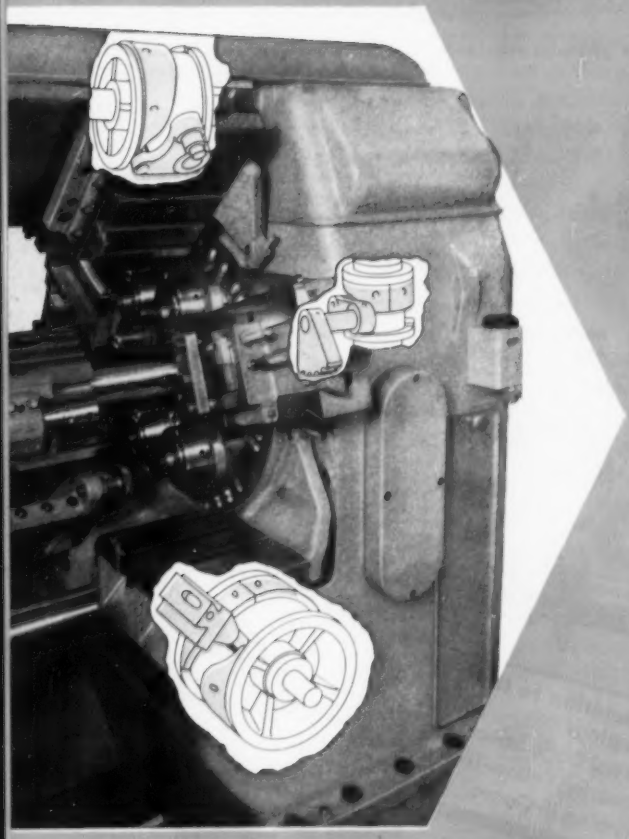
more power



1⅝" RB-6 Acme-Gridley with eccentric turning and forming attachments.

to you!

Acme-Gridley independently-operated direct cross-slide camming



Lets you use maximum machine horsepower for rapid metal removal—without chatter and at predetermined accuracy—throughout an entire run. Basic design of Acme-Gridleys built for heavy cuts calls for proper distribution of "beef" in the machine frame to rigidly support top, bottom and intermediate slides so that they can transmit power to the tip of the tool with no linkages.

Cross slides operating from their own cam drums not only improve overall machine efficiency, but extend the range of applications for which the machine can be tooled. And when, as in the case of Acme-Gridleys, ample frame strength is combined with short coupled power transmission to the tool, you've got a combination that pays off in two ways—improved performance and reduced maintenance.

LET US TELL YOU MORE ABOUT
***Acme-Gridley* BASIC DESIGN**

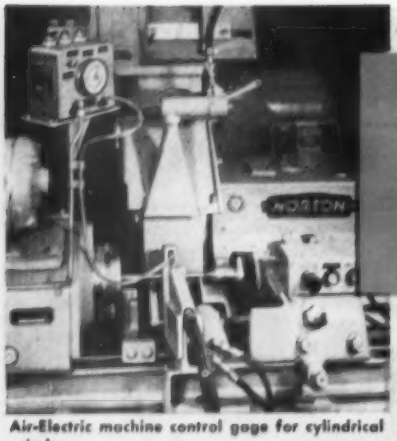
Independently-operated, direct camming is but one of many BASIC DESIGN features which are responsible for Acme-Gridley's outstanding performance records. May we send you additional information? Or, better yet, let us send a representative to discuss possible production short cuts with you.

National Acme

THE NATIONAL ACME COMPANY, 171 EAST 131ST STREET, CLEVELAND 8, OHIO

SALES OFFICES: • Newark, N. J. • Chicago, Ill. • Detroit, Mich.

How would you

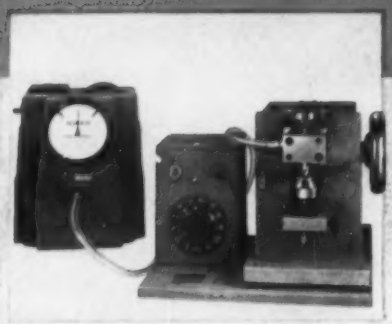


Air-Electric machine control gage for cylindrical grinder.

Gage for checking taper on piston skirts.

Recording individual measurements taken with an air-ring.

No. 247 radial play gage for ball bearings.



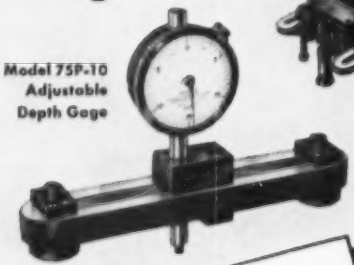
Gage for checking gyroscope rotor end play.

Series 205 Hole Location Gage checks holes in workpiece for parallelism.

Model 1000P-61 Adjustable Snap Gage

Series 1250 Hole Gage

Model 88P-10 Inside-Outside Diameter Gage



Model 75P-10 Adjustable Depth Gage

Series 45 Thread Pitch Diameter Gage

Federal's Solution to the Cost of Gaging:
Impartial Gage Selection
Engineering Follow-Through
Everything in Gages

Model 130 Electronic Comparator

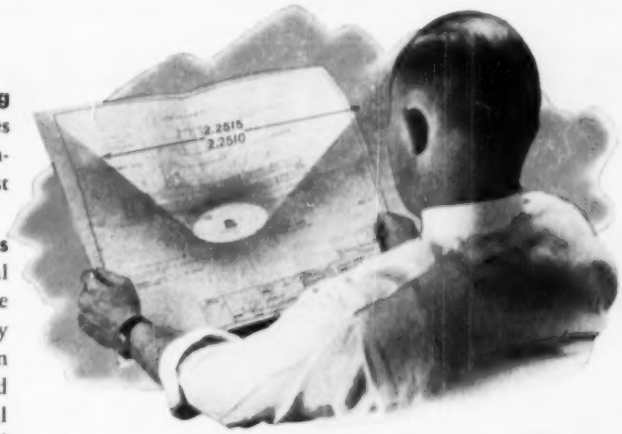
Model 136 Horizontal Master Comparator

GAGE THIS DIMENSION 10 times or 10,000 times?

It is claimed that 75% of all metalworking production is made up of small lots of 25 workpieces or less. This emphasizes that in most cases it is important to carefully select gages at the lowest cost commensurate with necessary accuracy.

Federal makes a complete line of all types of gages employing practically every system of visual gaging. Listed in our catalog and readily available from stock are countless Dial Indicator Gages ideally suited for everyday inspection of small runs. When a higher degree of accuracy, foolproof operation, and faster gaging are required, the purchase of a Federal Dimensionair Air Gage may pay big dividends. And where large production warrants the investment, we design and build automatic gages for high speed sorting and machine control.

When a manufacturer makes only certain types of gages, he naturally recommends these for all applications. For instance, a manufacturer who specializes only in Dial Indicating Gages obviously cannot meet every modern gaging requirement. Neither can an Air Gage manufacturer honestly recommend his type of gage for every measuring job. Those who buy the wrong gage can't be blamed if they don't know the facts.



Before you decide what gages you need, bring your problems to Federal. Our engineers, without bias, will suggest the *best* solution . . . and may save you considerable money. Write or call us today.

FEDERAL PRODUCTS CORPORATION
6128 Eddy Street • Providence 1, R. I.

- Air-Electric Gages
- Air Gages
  - a full line of accessories
- Automation Gages
  - Employing all gaging systems
- Grinding Gages
  - Continuous
- Dial Indicator Gages
  - Catalog and Special Types
  - Thousands of Designs
- Dial Indicators
  - The only complete line
  - Regular type — hundreds of Variations
  - Super-sensitive
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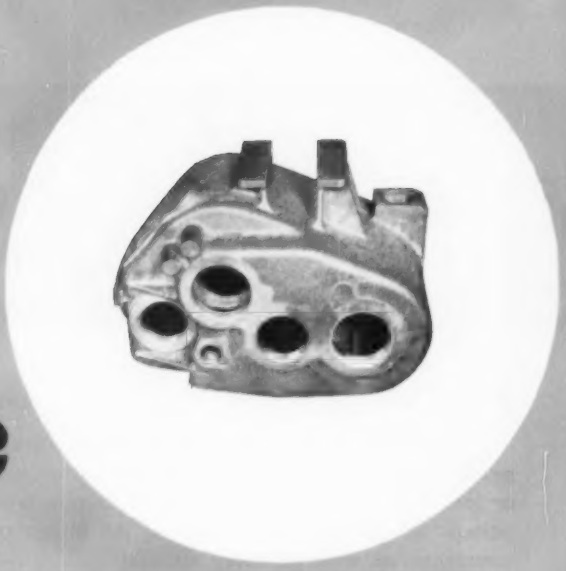
  - Test indicators
  - Lifetime
  - Dial Indicator Test Sets
  - Wetproof Indicators
  - Long range indicators
- Electric-Dial Indicator Gages
- Electronic Gages
- Micrometers
  - Indicating
- Master Setting Disc & Rings
- Multiple Dimension Gages
- In-process Gages
- Thousands of special designs for thousands of special needs

Ask **FEDERAL** *First*

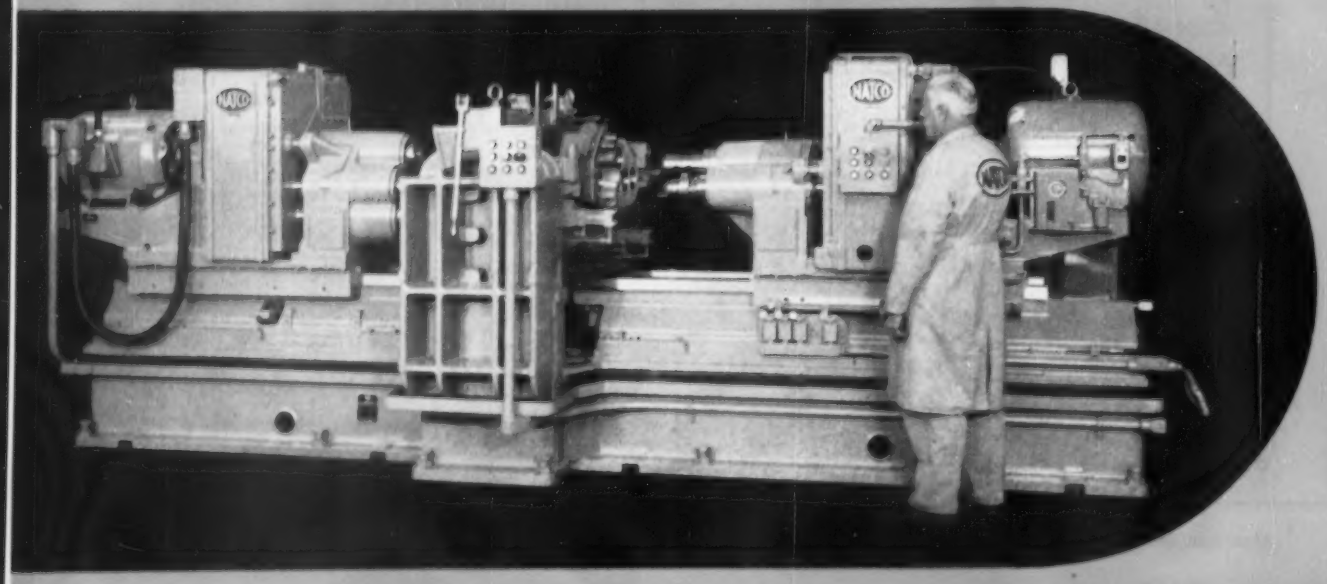
FOR RECOMMENDATIONS IN MODERN GAGES . . .

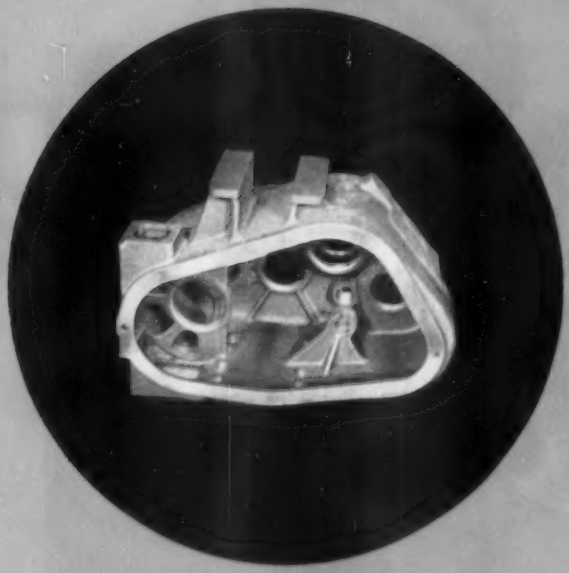
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging



Natco® Automatic Matches Boring Mill Accuracy

and quickly converts for five different jobs





This Natco two-way machine stepped in where automatics "fear to tread!" It replaced a precision boring mill, speeded production and didn't give up a tenth in accuracy! At The Frank G. Hough Co. boring mills were used for exacting tolerances on transmission parts for the Hough Payloader®. Higher production was desired.

Now with a Natco two-way automatic, Hough is getting production rates—not job shop rates. The Natco bores diameters to within .0005"—square with mounting face within .0005" per inch bore length. The machine also chamfers, counterbores and notches boss contours.

Versatile too! Hough processes five different transmission housings or covers with a single machine. After a typical production run averaging 100 parts, the machine is quickly converted to another job.

Ask for information about the PAYD (Pay-As-You-Depreciate) Finance Plan.

National Automatic Tool Company, Inc. *Richmond, Indiana*

Multiple-spindle drilling, boring, facing and tapping machines. Special machines for automatic production.

Call Natco offices in Chicago, Detroit, Buffalo, New York, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

NATCO

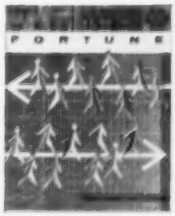
Notes from Natco...

Middle Age Spread

Having reached the age of 55 feeling as spry as the day we started, we at Natco are going to spread out. The demand for our products makes this necessary since we're anxious to give our customers the kind of deliveries they need.

After Jan. 1, 1957, when the job is finished, we'll have eight acres under one roof at our Richmond, Indiana plant. We figure it will increase our production capacity about 50%.

To take care of the increased need for Sales Service, we've already increased our staff about 50% and provided them with new efficient quarters.



Appreciating Depreciation

Depreciation, we've come to realize, is one of the least understood and most important aspects of the business picture today. Though we're far from experts on the ins and outs of this complex subject, we've undertaken to discuss the importance of looking at depreciation realistically in our current FORTUNE campaign. We'll be happy to send you reprints if you'll drop us a line.

Important Announcement

by HORTON CHUCK *Since 1851*

TO THE METALWORKING INDUSTRY

ON JULY 1ST, 1956, the Horton Chuck Division, Windsor Locks, Connecticut, became an operating Division of Greenfield Tap and Die Corporation, Greenfield, Massachusetts.

This step marks an important development in the history of these two companies, universally accepted as leaders in their respective fields.

"Greenfield" with its Ampco, Geometric and now Horton Divisions can offer to the metalworking industry the finest complete line of cutting tools and work holding devices obtainable.

The sales and distributor organizations of both Greenfield and Horton will continue to provide the excellent service which has been a hallmark in their years of continued growth and progress.

We take this opportunity to express our thanks to customers and friends of both companies for their fine acceptance and use of our products, and we pledge that the service and quality of which we are justly proud will continue to merit your patronage.

HORTON CHUCK — GTD AMPCO — GEO MET RIC — GTD

Greenfield Tap and Die Corporation

HORTON CHUCK DIVISION

WINDSOR LOCKS, CONN.

SPEED RECORD BROKEN

2,000 Horse Power Motor Shafts ROUGH and FINISHED in 2¼ hrs.

Former Time 9 hours

Fairbanks, Morse & Co., Beloit, Wisconsin, is getting this amazing production day after day on its *20 inch "AMERICAN" All-hydraulic Duplicating Lathe.*

These shafts are made from 7½" diameter by 84" long hot rolled stock weighing 1089 pounds. A 30 horse power roughing cut and 15 to 20 horse power finishing cut completes the operation.

Note particularly that a finish turned motor shaft is used for a template, showing the rugged stability of "AMERICAN" Template Supports.

The quality of Fairbanks-Morse's products are universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to them. "AMERICAN" Hydraulic Duplicating Lathes hold many production records for work of this nature. Let us show you what they will do on your work.

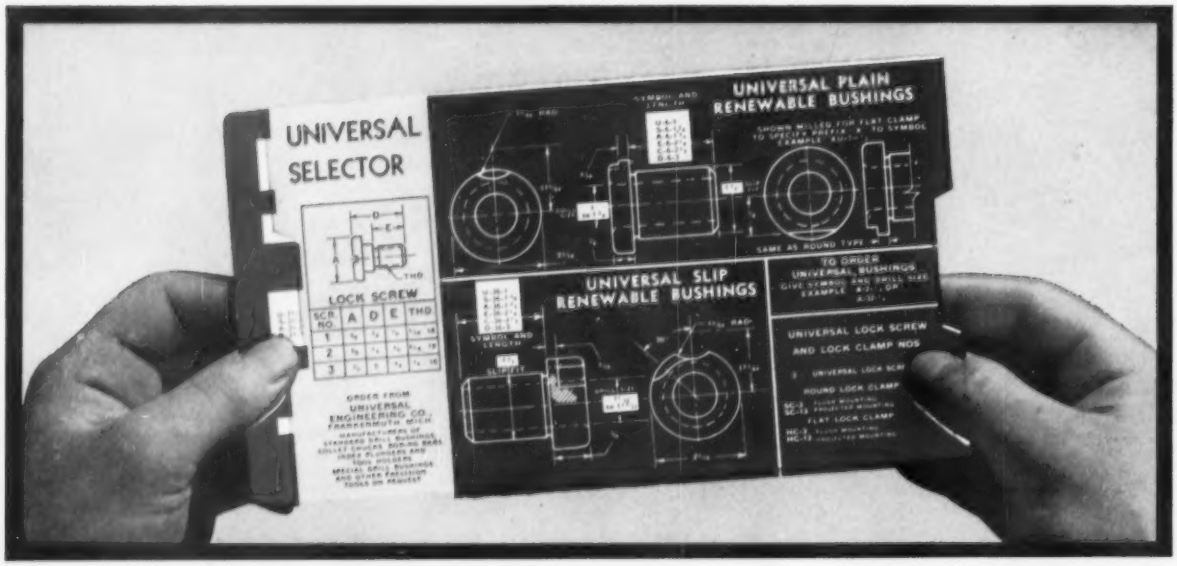
Send for Bulletin No. 35.

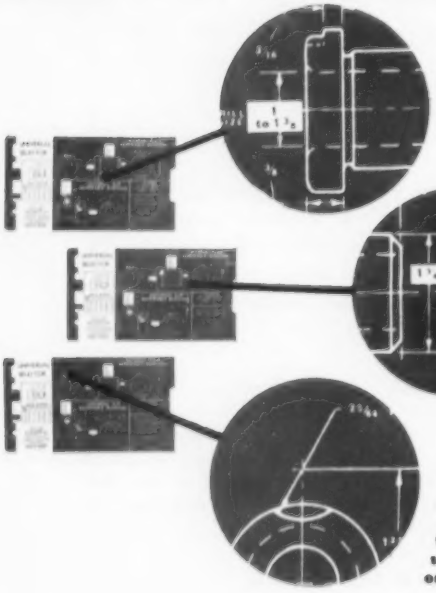
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

HOW THE UNIVERSAL DRILL BUSHING SLIDE CHART SIMPLIFIES JIG DESIGN

new plastic, pocket-size calculator gives all engineering data for the selection of all types and sizes of drill jig bushings up to 1¾" drill size





The SELECTOR is divided into four areas, one for each of the four types of bushings. The example shown here is for the plain renewable. Using this area, you move the slide until the correct drill size appears in the drill-size window.

Once the drill size is set up on the SELECTOR, all other factors now appear in the windows. This section, for example (shown actual size) shows correct bushing O.D. and dimension from center to flat for clamp.

This section shows the radius for lock screw. Every factor you need for drill bushing jig design as well as for ordering the correct bushing to fit that design is shown correctly, exactly, and at a glance on the SELECTOR.

A new service to regular users of drill jig bushings is this extremely practical plastic Selector slide-chart. When designing jigs, you will save many hours, and be certain of your accuracy, with the SELECTOR. It represents the result of six years experimentation and research by Universal Engineering Co. If you are an engineer specifying bushings and do not have one of these slide calculators—you can have one for your own design work by simply requesting it on your company letterhead. Don't wait—do it today!

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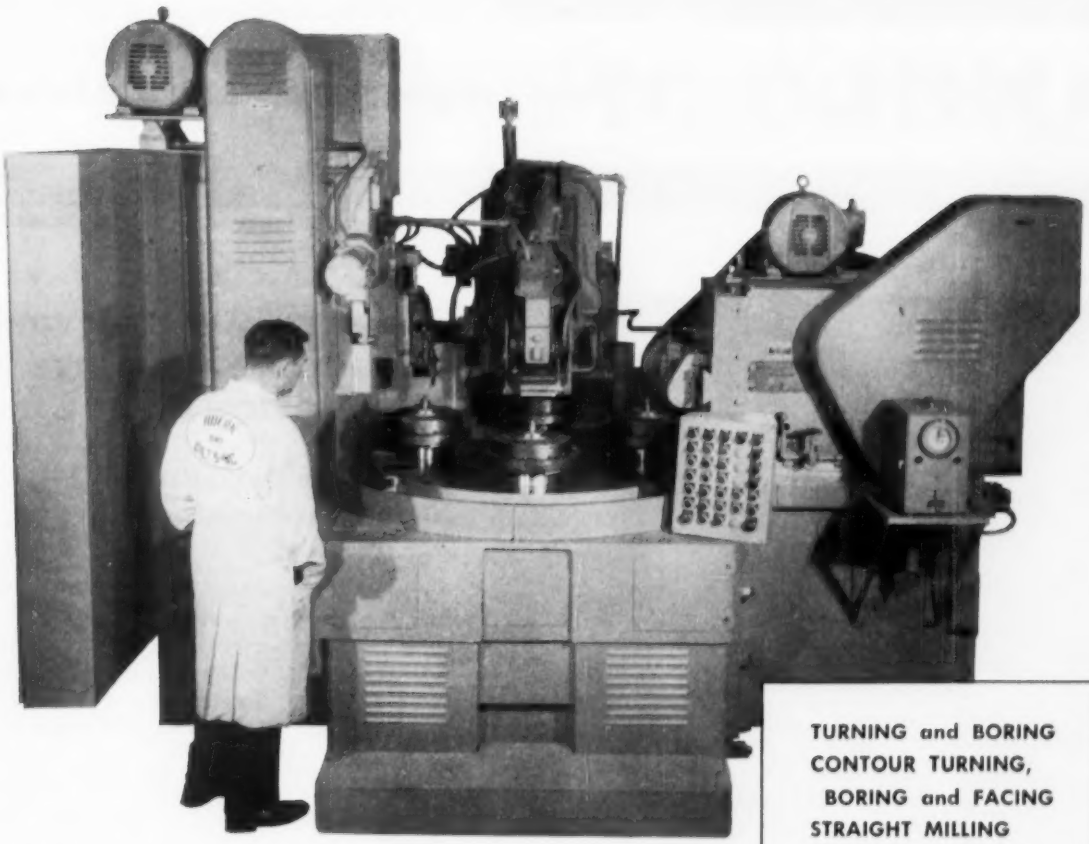
UNIVERSAL ENGINEERING CO. FRANKENMUTH 1, MICHIGAN



TURNING and BORING
CONTOUR TURNING, BORING and FACING
STRAIGHT MILLING
CONTOUR MILLING
PLANETARY MILLING
I. D. GRINDING
O. D. GRINDING
SURFACE GRINDING
SURFACE HONING

You can combine these finishing operations on one Hoern & Dilts indexing finishing machine →

Indexing Table: Mounted on pre-loaded roller bearings. Index accurate to .0002". By providing adjacent spindles with proper chucking devices, *both ends* of a piece may be put through identical or closely related operations.

Heads: Individually cam-actuated heads, each designed for a specific type of operation which may be performed vertically or horizontally as required. Heads self-contained, with individual electrical, pneumatic and lubricating systems.

Speeds: One over-all speed may be used, or a different speed at each station. Spindles may be stopped and locked in any predetermined position at any station.

Feeds: Individually adjustable for each head.

Grinding Operations: Wheels dressed and compensated during index.

Automatic Gauging and feedback adjustment available at all stations.

A Hoern & Dilts Indexing Finishing Machine handles with *one* chucking and one operator, the operations ordinarily performed by several operators using completely different types of equipment.

This advanced approach to increased, more accurate production is accomplished by arranging a variety of self-contained heads around a central indexing table in which the spindles are mounted. Since all the operations are performed with a single chucking, all the proper relationships are maintained.

Hoern & Dilts engineers will welcome the opportunity to cooperate with you on any high production finishing operation.

HOERN & DILTS DIVISION

The New Britain Machine Company
Saginaw, Michigan

OTHER NEW BRITAIN MACHINE TOOL DIVISIONS:

New Britain-Gridley Machine Division
New Britain, Connecticut
Automatic Bar and Chucking Machines
Precision Boring Machines and
New Britain +GF+ Turning Lathes

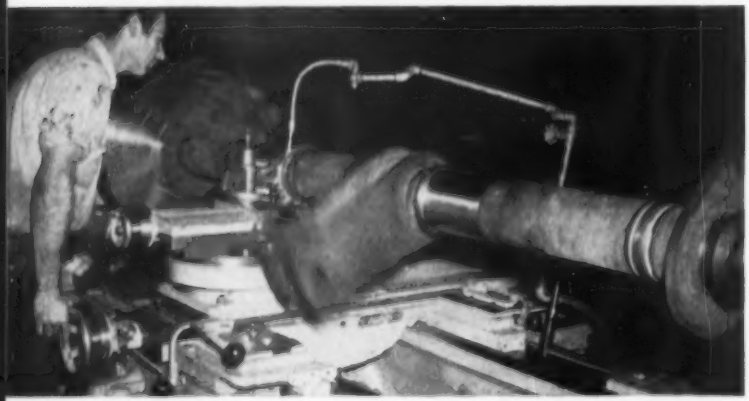
Lucas Machine Division
Cleveland, Ohio
Precision Horizontal Boring, Drilling and Milling Machines

AXELSON production

AXELSON MANUFACTURING COMPANY

PRODUCTION. Heavy-interrupted roughing cuts are performed on the OD and ID of gear box support adapters on this 20" Axelson Heavy-Duty Lathe. Finishing operations include facing, turning and chamfering.

PRODUCTION PARTS. Cast steel parts for The Conveyor Company's mobile sweeper are turned, bored, faced and chamfered with carboloy tools using quick change tool block to speed roughing and finishing operations.



JOB SHOP MACHINING. 93" long axle assembly for hydraulic boom crane is rough and finish turned on this 32" Axelson Heavy-Duty Lathe, which has a 41⅛" swing and a 20' bed.

SWEEPER MANUFACTURER PUTS COMPLEX PARTS ON PRODUCTION BASIS . . .

maintains flexibility for job shop machining.

Street sweepers, conveyors, industrial scale equipment, vegetable packing machinery, batch and rock plants, are only a few examples of products manufactured by The Conveyor Company, Los Angeles, where machine tools require maximum flexibility and ruggedness combined with extreme accuracy to meet the wide range of possible applications.

Some of these products are on a production basis, such as street sweepers. Even these require maximum machine flexibility, since the sweepers have many complex and varied parts, which must be machined to close tolerances. Two typical production turning jobs are performed on 16" and 20" Axelson Heavy-Duty Lathes.

Gutter boom shaft housings, in 50-piece lots, are rough and finish turned, faced, chamfered and bored on the Axelson 16" lathe. Parts are cast steel 7½" diameter, 10" long. Accuracy is ±.002.

The 20" Axelson Heavy-Duty Lathe is used for production of cast steel gear box support adapters. Heavy, interrupted roughing cuts are performed on the OD and ID. Other operations include rough and finish facing, turning and chamfering. Parts are 6⅞" diameter, length 7½" and weigh 30 lbs. Accuracy is ±.002. Carboloy tooling is used for both applications.

A 32" Axelson Heavy-Duty Lathe with a 20' bed is used for turning large shafts and other heavy-duty parts for batch and rock plant applications.

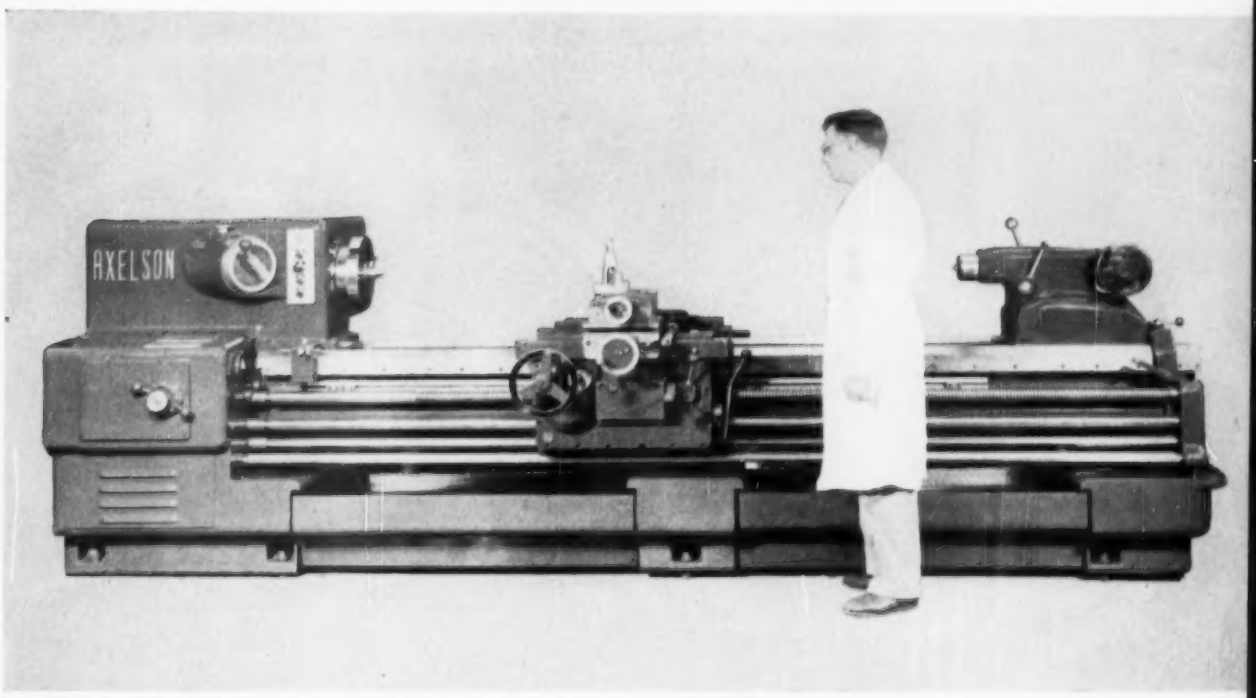
For a complete description and detailed specifications on Axelson Tool Room, Medium-Duty and the new 25/16 and 32" Heavy-Duty Lathes:

Write for bulletins A8--5507 and 5504.

AXELSON **Manufacturing Company**
Division of U. S. Industries, Inc.

and maintenance news

DIVISION OF U. S. INDUSTRIES, INC./ 6160 SOUTH BOYLE AVENUE, LOS ANGELES 58, CALIFORNIA



ONE CONTROL LEVER provides 32 spindle speeds (forward and reverse) from 11 to 1600 RPM.

New 25/16 heavy-duty lathe simplifies operator control . . .

provides 40 horsepower over entire 32 spindle-speed range

Maximum flexibility is combined with high horsepower, compactness, and extra-wide speed range in the new Axelson 25/16 engine lathe. The new model features a swing over the bed of 25" and over the cross slide of 16".

For heavy cutting, forty horsepower is maintained over the entire range of 32 speeds. Yet, this versatile lathe is extremely compact. With the hydraulic pre-selector, it can be used for heavy-duty single set-up operations or can be easily converted to production operation. Additional convenience is provided by a 2-lever lead and feed change for 66 combinations.

Power clutch wear adjustment is eliminated by the use of a hydraulic clutch. Speed changes are made through involute clutches; the headstock contains no sliding gears.

Maximum rigidity and permanence of alignment are provided by the single-unit tailstock body. For safety and efficiency, the gear box and end train are totally enclosed and fully lubricated. The 25/16 has longitudinal and cross feed rapid traverse in four directions. All feed and rapid traverse movements are controlled by two convenient hand levers.

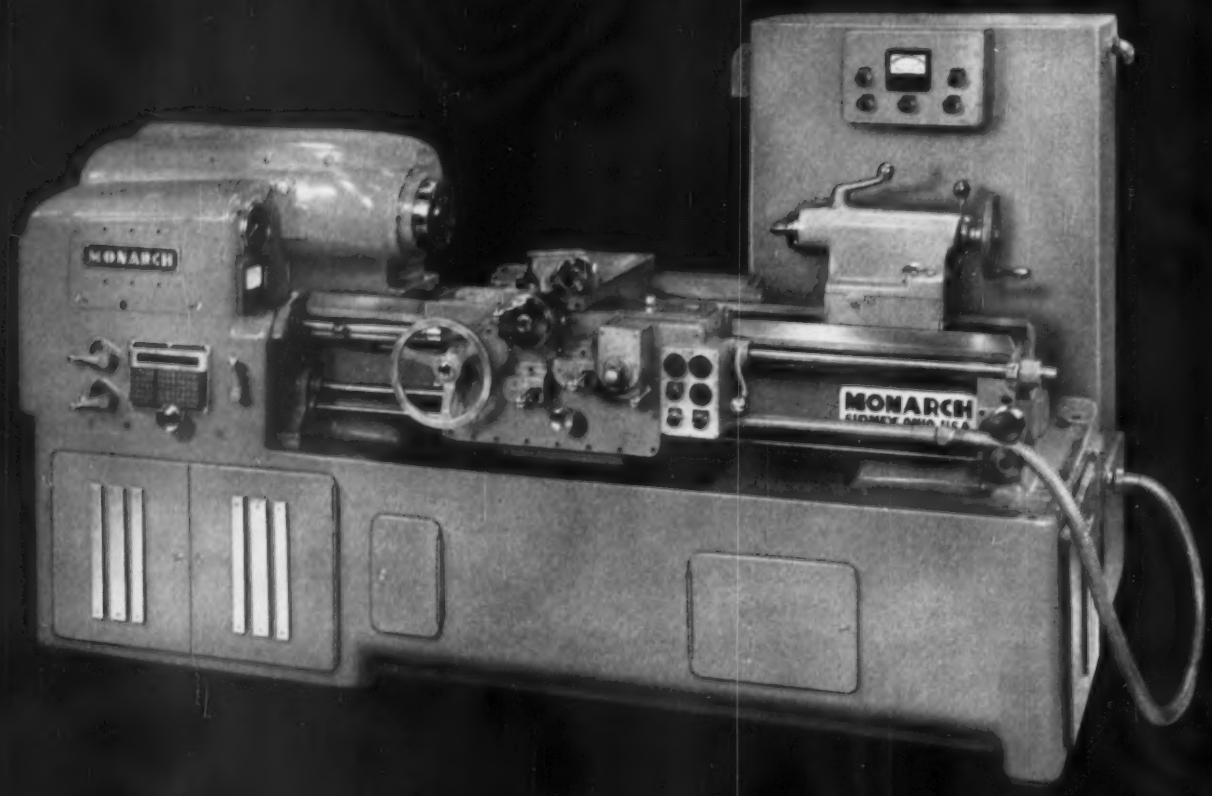
The large traverse dial on the apron handwheel is graduated in thousandths for ease and greater accuracy in positioning carriage. Lead screw may be reversed from apron, an important feature in tool room work.

An exclusive 25/16 Axelson Lathe feature is the 5-position diameter power cross-feed disconnect stop and 2-position longitudinal power-feed disconnect stop.

CENTRALIZED HYDRAULIC PRE-SELECTOR is one of the keys to the ease of operation and unusual flexibility of this lathe. There is one lever for 32 spindle speeds (forward and reverse) arranged in true geometric progression from 11 to 1600 RPM. The operator can pre-set a new spindle speed while the lathe is in operation, move to the end of the bed and, without returning to the headstock, automatically switch to the preselected speed by operating a lever on the apron. Such an arrangement offers clear advantages in control, accuracy and convenience.

NOW—Monarch 10″ Model EE Performance . . .

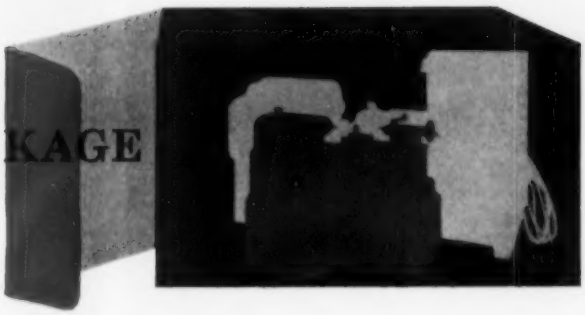
The Series EE, Model 1000 Precision Lathe for toolroom use. A machine for master toolmakers. Combines super-precision, extreme versatility and productiveness. Consider the cost reducing possibilities represented by the specifications listed below.



Swing over bed	15½″
Length between centers	30″ and 54″
Main drive motor	20 H. P.
Weight, 30″ machine	10,000 lbs.
Infinitely variable speeds up to	2,000 R. P. M.
Thread and feed changes	66

Electronic main drive motor control
Electric speed change
Four-way power rapid traverse
Built-in constant surface cutting speed

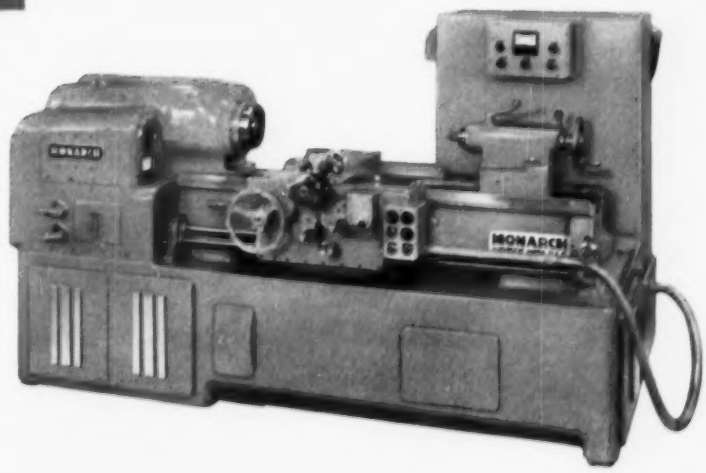
. . . in a KING-SIZE PACKAGE



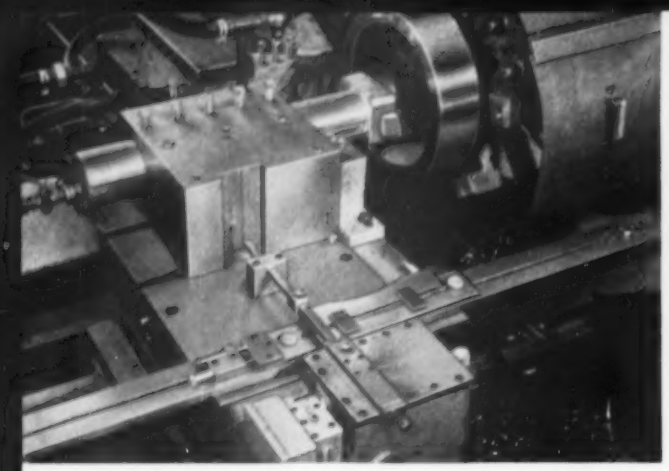
Are you faced with out-of-the-ordinary precision turning requirements? Have you longed for lathes having greater power, speed and versatility? If the answer is yes, here's great news.

The famous 10" Monarch Model EE Lathes now have two husky big brothers—the Series EE, Model 1000 Precision Lathe equipped either for toolroom or manufacturing use. They've got everything that's sold more than 6000 ten-inch Lathes to date—plus! Plus greater swing, more distance between centers, more power, more beef, more capacity and *inbuilt constant surface cutting speed*. Come see them in action!

It's EEze to reduce your turning costs with the Monarch family of EEs. Write for full information.
The Monarch Machine Tool Company, Sidney, Ohio.

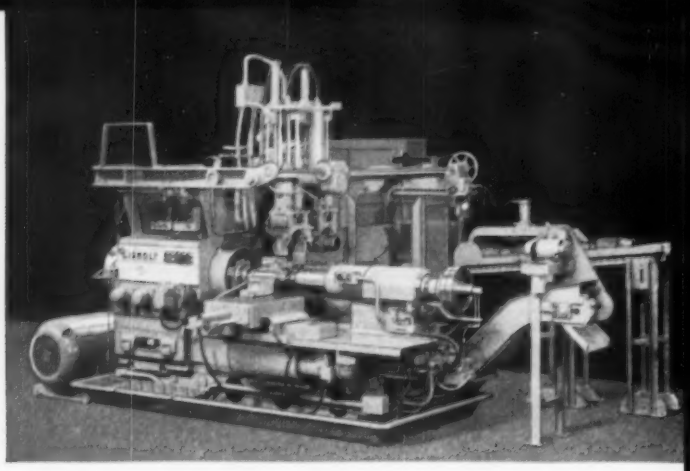


The Series EE, Model 1000 Precision Lathe for manufacturing use. For precision production on all types of lathe operations except thread chasing. This machine is provided with a simplified six-feed gear box with either one of three feed ranges being available. It's stripped down, ready for action in *your* plant.



NO. 24—WITH CHUCK

Ninety pounds of tough bearing steel are removed in two 8-minute operations on this job. One No. 24 handles six types and 24 different sizes of inner and outer bearing races with ease and efficiency. A JETracer on the rear independent slide simplifies spherical, straight and taper boring operations—also improves accuracy and finish and lowers unit costs.



NO. 24—ON TAILSTOCK-SUPPORTED EXPANDING ARBOR

Automatic loading and unloading are part of the machining cycle on this setup. Utilizing overhead clamps and a traversing carriage arrangement, the No. 24 makes fast work of these tough steel tool joint forgings. The operator has separate push-button control over all machine and handling functions for faster, easier setups and change-overs.

YOU CAN REDUCE COSTS ON

NEW GISHOLT MASTERLINE NO. 24

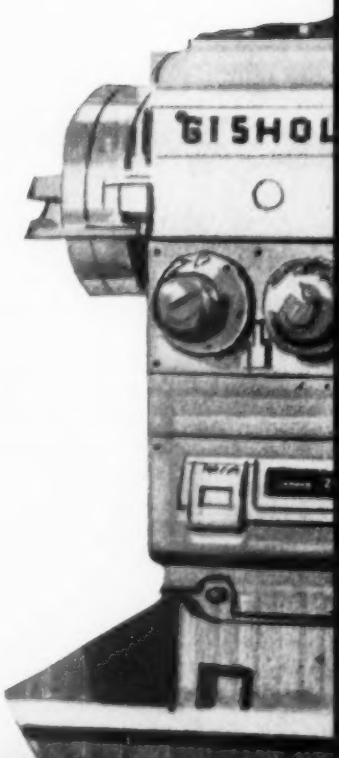
WHETHER YOUR LARGE PART PRODUCTION INVOLVES long, steady runs or small repeat lots, you'll find definite ways to cut costs with this new Gisholt MASTERLINE No. 24 Automatic Production Lathe.

And you can realize these savings whether your work has to be held on an arbor, in a chuck or special fixture, or between-centers with work driver and tailstock—for the big No. 24 will handle parts all four ways.

Cost cutting with this extra powerful (up to 125 h.p.) single-spindle automatic is inherent within its standard automatic cycle. Hydraulic control of all carriage and auxiliary slide movements—plus automatic stopping and starting of the spindle—lets one operator handle two or more of these machines, or perform other jobs during machining time.

Still more savings are realized through faster, easier setup and shorter change-over periods. During setup, all hydraulic actuated movements may be manually controlled. Spindle speeds, feeds and stops are easily changed. This means you can produce a variety of large parts—or handle small repeats—without excessive down time between sizes or jobs.

Whatever type of large part you are producing now—or planning for the future—your Gisholt Representative can show you how and where the No. 24 will produce it for less cost. Call him today—or write Gisholt for complete information.



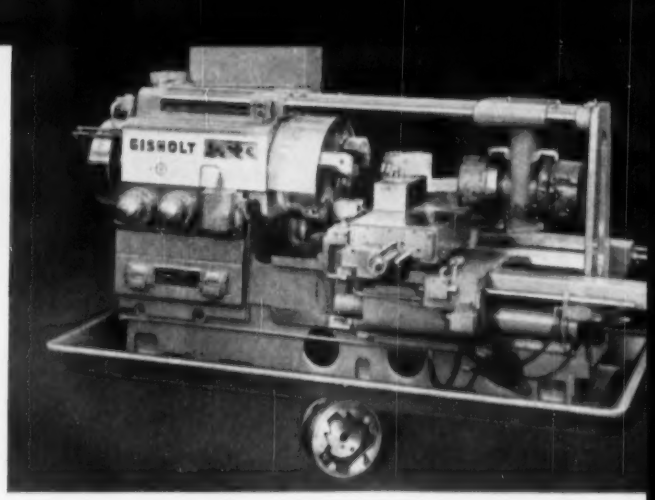
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

NO. 24—WITH CHUCK AND TAILSTOCK SUPPORT

With this setup, husky airplane drive gear and propeller shafts are completed in two fast operations on two No. 24's. One man handles both machines. The first operation is shown. Five diameters are machined plus turning, facing and chamfering. The second operation, on the other end, is similar. Floor-to-floor time: 12 min. per operation with 75 lb. of metal removed.

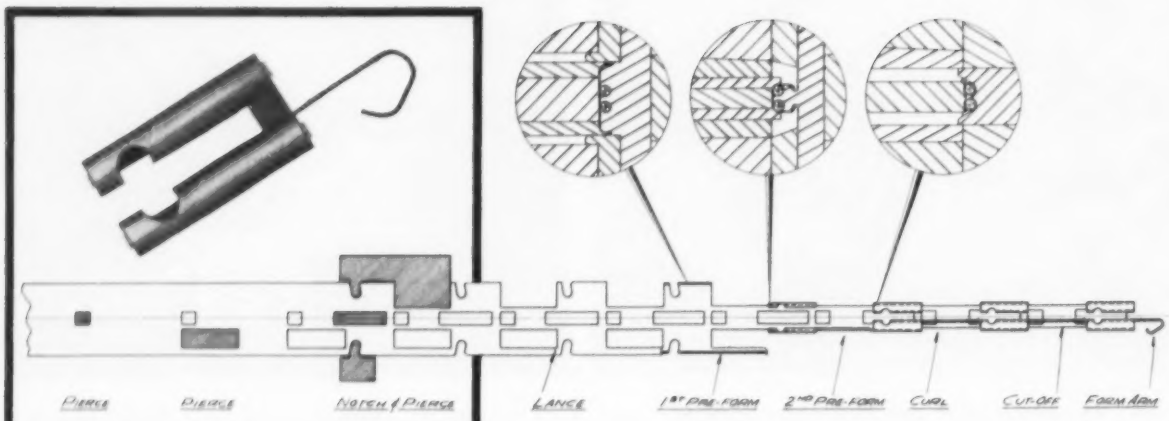


NO. 24—WITH CHUCK AND LOADING ARBOR

Here, standard tooling plus a unique, indexing-loading arbor arrangement on the No. 24 has cut costs and reduced effort in the machining of heavy cast iron diesel cylinder heads. Floor-to-floor time is only 1.2 minutes. More time is spent making chips because most of the loading-unloading operation is performed while the tools are working on the next part.

LARGE PART PRODUCTION WITH THE

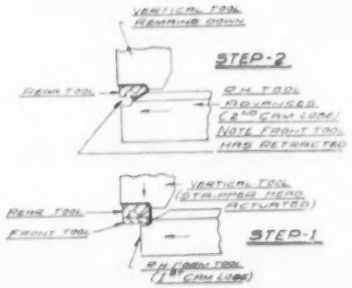
AUTOMATIC PRODUCTION LATHE



Produced Complete! No Secondary Operations! on the U. S. MULTI-SLIDE®

DETAIL OF FINAL FORMING OPERATIONS

The drawings above and at the right indicate the sequence of operations in the dies and forming position to complete the intricately formed metal stamping.

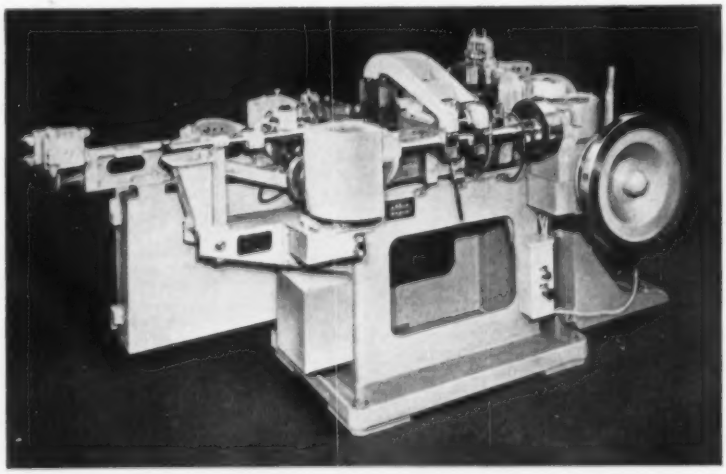


The intricately formed metal stamping (shown four times actual size above) is just one of the many different types of stampings which can be produced without secondary handlings on the U. S. Multi-Slide.

Eliminate secondary operations — reduce costs — increase production: You, like all manufacturers, are interested in achieving these results. In the pressroom this may be accomplished through the use of the U. S. Multi-Slide Machine. Standard machine equipment includes ram action, four slide forming position and vertical stripper movement. These various movements make the U. S. Multi-Slide a versatile machine and allow for the production of complicated formed metal stampings without secondary handlings.

Ask for a copy of Bulletin No. 15-A which illustrates and describes these machines and contains the specifications for the four sizes now being built.

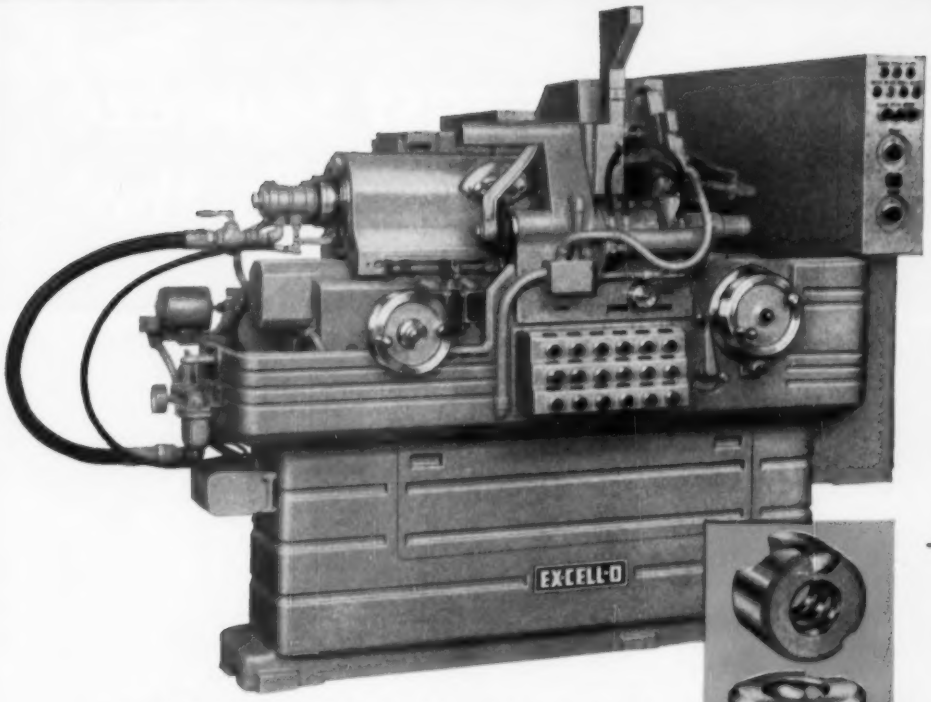
#28 U. S. Multi-Slide Machine used with appropriate tooling to produce the part shown above.



U. S. TOOL COMPANY, INC.

Ampere (East Orange), N. J.

Builders of U. S. Multi-Slides
U. S. Multi-Millers
U. S. Automatic Press Room Equipment
U. S. Die Sets and Accessories



Ex-Cell-O Style 39-A Precision Internal Thread Grinder equipped with automatic work handling equipment. This machine loads, locates, grinds threads and ejects steering gear ball nuts in a completely automatic cycle.

EX-CELL-O
Thread Grinders
Manual – Automatic – Automated

These standard machines are grinding thread gages, machine tool lead screws, innumerable aircraft parts, automotive steering mechanisms and pinions, worms, taps, and many similar workpieces.

Precision thread grinders in this Ex-Cell-O line range from manually-operated models, for toolroom and for short runs, to high production automatics, to styles equipped with automatic work handling equipment. There are five models designed to meet your every requirement.

For specific information on thread grinder operations or a quotation on a machine for your requirements, call your local Ex-Cell-O representative or write Ex-Cell-O in Detroit.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-5

EX-CELL-O STYLE 33 FOR EXTERNAL THREADS: An accurate production machine, automatic except for loading, unloading, and moving the cycle lever. Can be arranged for tapered grinding and for eccentric relief grinding.

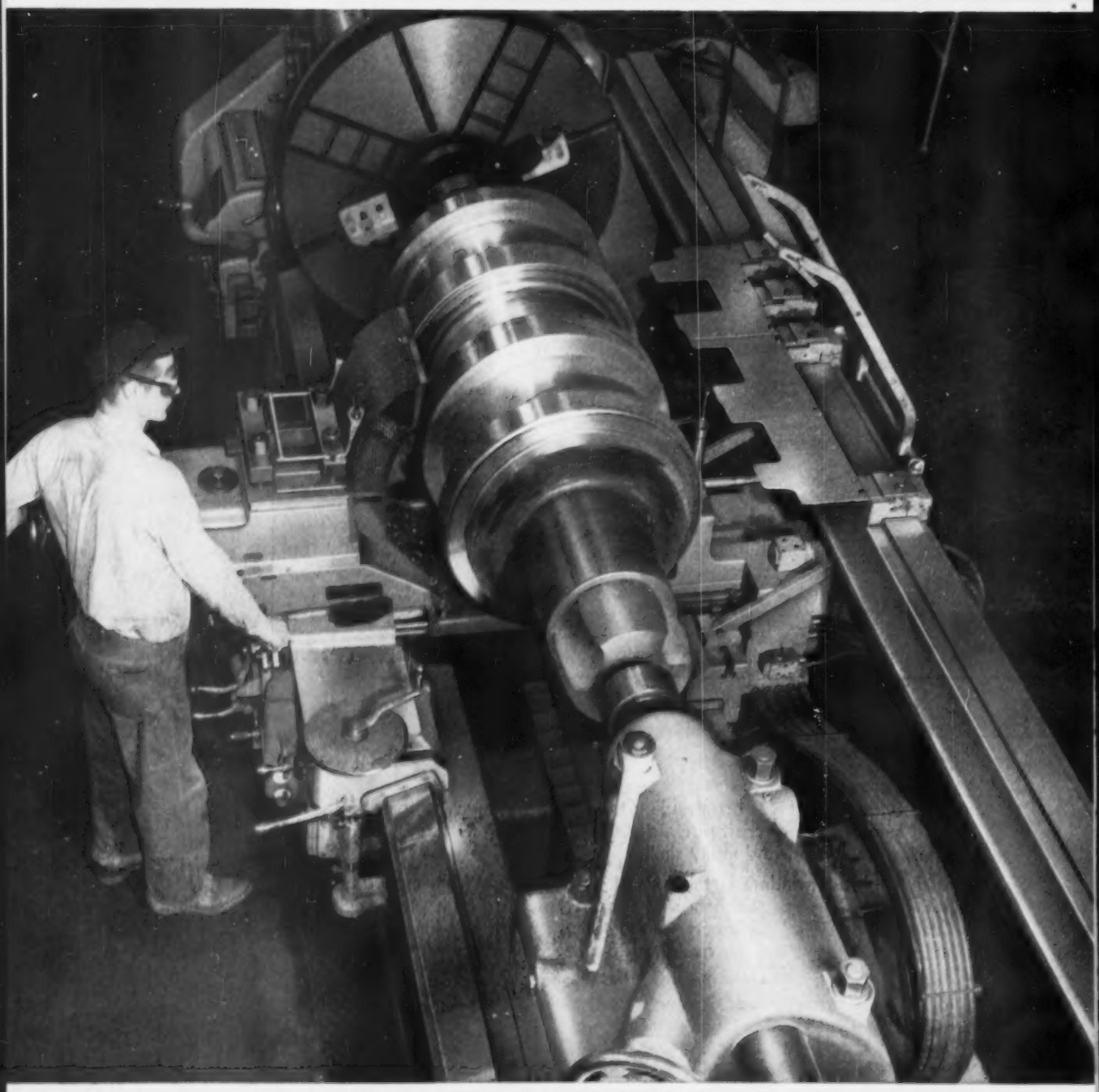
EX-CELL-O STYLE 36 FOR LONG EXTERNAL THREADS, also available with internal attachment. A high production machine with easily adjusted work cycles.

EX-CELL-O STYLE 50: A versatile machine for external work . . . also available with internal attachment.

EX-CELL-O STYLE 120: Our largest Thread Grinder. Grinds 10 feet of thread in one setting. Accommodates 12 feet of stock between centers.

XLO
EX-CELL-O for PRECISION

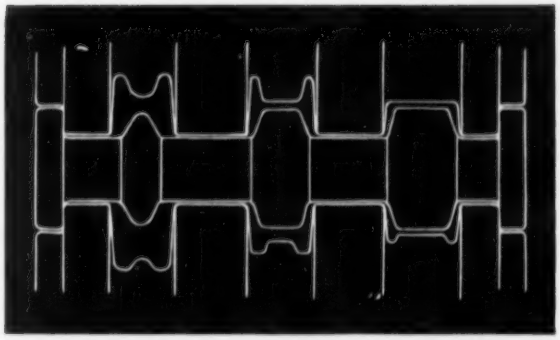
LeBlond Lathe eases cost squeeze ...on rolls that



A set of Shape rolls of 30½" dia. x 51" body cast alloy semi-steel are turned to .005" tolerance in 94 hours on this 50" LeBlond Roll Contouring Lathe. Set-up time ½ hour. Clamped-on and brazed-on carbide tips are used at 48 rpm, .040 ipr feed. Conventional roll lathe took 245 hours for the same set of rolls.

squeeze channels from blooms

U. S. Steel
Lops 151 Hours Off
245-Hour Roll-Turning Job.



Typical roughing rolls for 8" channel

Every day at U. S. Steel's Clairton Works, Clairton, Pa., miles of "hotter-than-orange" steel are squeezed through the passes of rolls like these for reduction, elongation, shaping. They come out as finished structural steel for the "jungle-gym" frameworks of modern buildings. Turning these costly shape rolls with their steep-angle contours used to keep a lathe running *245 hours on a set of roughing rolls* at U. S. Steel. Tool life was short and the job required highly skilled operators. Stepped-up schedules called for a new solution to this tough-nut production problem.

A LeBlond 50" Roll Contouring Lathe, as recommended by Pittsburgh Distributor, Barney Machinery Co., immediately slashed the 245-hour turning time by an astonishing 61.7%. Now U. S. Steel *saves 151 hours on one set of roughing rolls*—more than enough time to turn out two more just like it. Tool life is greatly improved and less experienced operators can handle the work.

The 50" LeBlond Roll Contouring Lathe is equipped with two-directional hydraulic tracing. A single valve automatically controls two hydraulic motors for cross and length feed. A stylus follows a flat template mounted at the back of the lathe. Feed and speed can be varied during a cut without leaving a tool mark. For roughing, hydraulic cross feed can be by-passed and length feed used separately. This enables operator to cross feed manually, use template as length stop. Mechanical power rapid traverse to carriage and cross slide is also provided. All controls are located conveniently at the apron. The lathe uses a 40 constant horsepower DC motor, has nine speed changes in the headstock, delivers infinitely variable speeds from 1 to 165 rpm.

Whether your turning jobs involve specialized production like roll-turning, or call for high precision, high production—investigate LeBlond's complete line of 76 lathe models. LeBlond engineers will help you get a better turning job, faster. Write today or see your nearby LeBlond Distributor.

Ask for complete information on Roll Contouring Lathes in 25", 32", 40" and 50" sizes.

Turned faster by

LeBLOND *of Cincinnati*

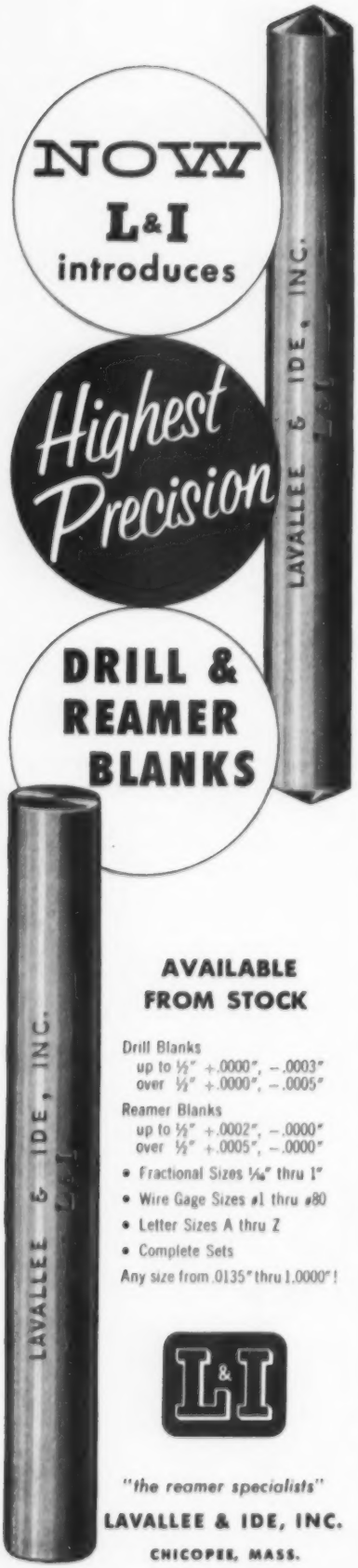
THE R. K. LEBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 66 YEARS*

NOW
L&I
introduces

Highest Precision

DRILL &
REAMER
BLANKS



AVAILABLE
FROM STOCK

Drill Blanks
up to ½" +.0000", −.0003"
over ½" +.0000", −.0005"

Reamer Blanks
up to ½" +.0002", −.0000"
over ½" +.0005", −.0000"

- Fractional Sizes 1/16" thru 1"
- Wire Gage Sizes #1 thru #80
- Letter Sizes A thru Z
- Complete Sets

Any size from .0135" thru 1.0000"!

L&I

"the reamer specialists"
LAVALLEE & IDE, INC.
CHICOPEE, MASS.

Letters . . .

To American Machinist
330 W 42nd St, N Y 36, N Y

Building Blocks Will Work

I certainly agree that "Building Block" machine tools (AM—July 16 '56, p113) seem to be the logical answer to the demands for more special and more automatic equipment. We believe that as many standard units as possible from which to build these special machines is the only approach to do it at something approaching reasonable cost. In addition, it enables us to have units of a tried and proven nature. In other words, we are working along the lines of building ourselves a huge Meccano set from which to construct at least the basic structure of today's special machines.

This scheme also gives a degree of flexibility to handle the model changes which appear to be coming at more frequent intervals in all our mass-produced products. One recent requirement is that each operating member of a transfer machine be a self-powered and self-contained unit, instead of being driven from a central system. This also adds flexibility in the case of design changes in the product.

The standardization of bases is a little more difficult but certainly holds some possibilities. Use of welded structures has permitted quite a lot of flexibility in machine design by eliminating pattern costs. They also lend themselves to some reworking by cutting and welding, which is not possible with cast bases.

The main problem with this "Building Block" idea is standardization between various machine tool builders, as everyone, of course, wants to stick to his own standard. However, some standardization would seem possible in respect to mounting dimensions, heights, and the like without destroying initiative and individual design so far as the operating mechanism is concerned. As we all know, a certain amount of standardization has already taken place between manufacturers of hydraulic components. To get such a program of standardization initiated among machine tool builders, it would probably have to be spark-plugged by an agency such as JIC.

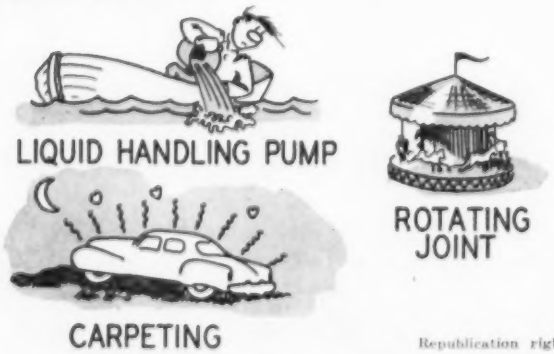
Name Withheld

Building Blocks

In reference to your article on unitized machine tools (*AM*—July 16 '56, p113) I believe this method of building machine tools will undoubtedly come into more general use in the future. Whether we shall have any great amount of interchangeability between builders rests in the future. Such standardization would have to be carried on through either a JIC or ASA committee, as the Justice Department does not allow any great amount of cooperation between builders. They refer to it

GRINETICS

By D G SMITH



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DOW

A FEW POUNDS make a big difference when jigs have to be moved manually several times an hour.

MAGNESIUM FOR LOW-COST TOOLING

Lightweight magnesium tooling plate costs less to buy, less to fabricate and less to use

• **COSTS LESS TO BUY**—Jigs and fixtures made with magnesium cost you less in every way. Magnesium tooling plate costs less than commonly used lightweight tooling materials.

• **COSTS LESS TO FABRICATE**—Magnesium jigs and fixtures are easy and economical to build, too. The reason is that magnesium tooling plate is easy to machine, easy to weld. It has guaranteed flatness, excellent dimensional stability and freedom from porosity.

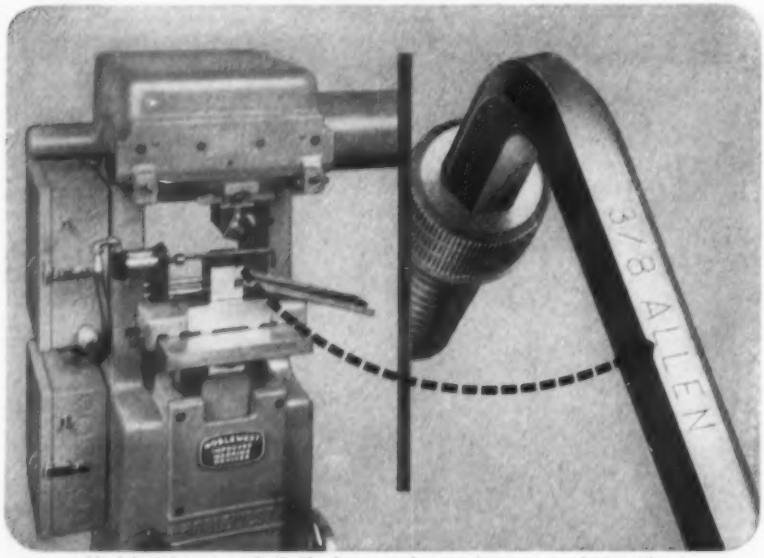
• **COSTS LESS TO USE**—Handling costs are also lower when you use magnesium tooling plate. Magnesium weighs one fourth as much as steel and only two thirds the weight of aluminum. By making your jigs and fixtures with lightweight magnesium you'll increase worker efficiency and reduce lost-time injuries.

For more information about magnesium tooling plate contact your nearest supplier of Dow magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA 371BB.

AVAILABLE FROM STOCK AT: Copper and Brass Sales, Inc., Detroit, Mich. • Fullerton Steel and Wire Company, Chicago, Ill. • Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Company, Los Angeles, Calif. • Vinson Steel and Aluminum Co., Dallas, Texas.

you can depend on DOW MAGNESIUM DOW

ANOTHER LEADER OF INDUSTRY MARKS WITH NOBLEWEST

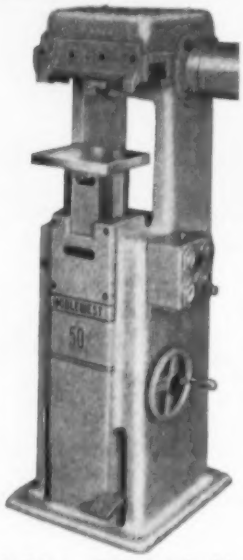


Model 50P1—395 Roll Marks manufacturer's name and size identification permanently into all sizes of Allen Head hex wrenches.

HIGH PRODUCTION MARKING

WITH NEW

Cyclomatic Control



This general purpose marking machine combines the original NOBLEWEST Roll Marking process with CYCLOMATIC CONTROL . . . an exclusive NOBLEWEST electro-pneumatic circuit for completely automatic cycling. When set for automatic operation the machine cycles continuously with no further attention required from the operator. A dual control system also provides for semi-automatic operation or for short production runs. This model can also be equipped with an air ejection system (see above) plus an automatic hopper or dial feed. The basic Model 50P1 features a low price, plus quick delivery! For additional details on how NOBLEWEST Marking Machines, tools and dies can lower your production costs, write the Noble & Westbrook Manufacturing Company, 17 Westbrook Street, East Hartford 8, Conn.

At left are Noblewest Precision Roll Marking Dies used for marking Allen wrenches. Inscription is duplicated three times on each die, thus tripling the die life.

May we send you a copy of our new catalog containing the complete NOBLEWEST line of MARKING MACHINES and MARKING TOOLS? Just send us your name and title on your company letterhead.

MARK IT BEST WITH

NOBLEWEST

MARKING MACHINES • MARKING TOOLS

Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

as collusion, and any collusion between the tool builders is taboo.

Company standardization of this kind is going on all the time. In the SAE Journal, Jan 1930, is an article I wrote and presented at the SAE Production Forum in Cleveland, entitled, "A Production Machine Tool of Elastic Design." This shows a number of machines built largely from standard units. At the present time, for our transfer machines, we have standard milling heads from 1 hp to 100 hp, standard feed slides, power drill units, tapping units, and other components. Many of these are made in quantity and carried in stock, and the transfer machine is built up from these units, plus the carriage or bed with the transfer bar, all of which is generally special.

It is perhaps being a little optimistic to expect that there would be a great amount of salvage if the workpiece is changed very greatly. With horsepower variations from 1 to 100, we must realize that different size heads would generally require a different size feed slide. I don't believe we would want to build a 1 hp head having the same dimensions as a 100-hp head. The idea is ridiculous.

So the standardization of dimensions can be carried on only within limits. However, many companies have made a standard, as we have, having standardization units of their own, and I believe this will expand. We have carried the building block idea a little further in the skin mills we build but, so far, have carried no head or other parts in stock. We have just made them up as required.

Joseph B Armitage,
v-p, consultant
Kearney & Trecker Corp
Milwaukee

Who Wants to Argue?

For some time, everyone has had some degree of interest in the status of the Federal Income Tax. After all, it is felt in every walk of life; both at home and in business. The tax collector, in effect, owns half of every machine shop in our country. What? Well the principal reason for owning a machine shop is the hope of making a profit from its operation—and the tax collector gets about half of the profit. Thus, the tax should be, as far as possible, like Caesar's wife, above suspicion.

However, many people in high places don't think it is. The former Commissioner of Internal Revenue advocates abolition of the Federal Income Tax; says we need an entirely new system. The Governor of Utah claims that the tax is illegal

because grants for foreign aid are beyond the powers of Congress. Last week a man of respectable past performance in financial problems wrote us to say that he can prove this Federal Income Tax illegal because it is not a "tax on incomes" under Amendment XVI.

What is your opinion? Debate is little used in settling financial problems but, in this case, a "letters debate" could result in some interesting ideas. We would appreciate the views of our readers on the legality of the Internal Revenue Code of 1954. And we would particularly like to hear arguments defending the Code's legality. Arguments against the Code are abundant. Address your letters to Backlash editor.—Ed.

Beryllium Copper

I have been unable to find any literature on the machining of beryllium-copper, but here's how we solved the problem: Two facing surfaces, about ⅝-in. square and 1.475 in. apart had to be milled to a very good surface suitable for plating, and parallel within 0.0005 in. per in. For roughing, we used a ½-in., 4-flute end mill at slow speed and slow feed, and cut dry because heavy oil, degreasing fluid, or a mixture of both caused chips to collect and the heat burned the metal.

The operation sheet called for leaving 0.014 in. for finishing after roughing, but we left only 0.005 to 0.007 in., and 0.003 in. would have been better. The finish cut was made with a fly cutter. The tolerance was +0.003 −0.000, so we cut until the No Go gage would almost enter because when the work was released from the hold-downs it contracted and made a perfect fit to the Go gage.

Cutter speed was 1725 rpm, with slow up-and-down hand feed, watching for cutter stalling. The head air feed could not be cut down slow enough and, if the cutter stalled, return marks would show on the finished face. Only a single carbide cutter was used in the fly cutter.

The cutter was driven by a round belt, and the maximum depth of cut we could take was 0.003 in. We took a finish chip of 0.0005 in. or less for final finish.

Geo A Sammet
Watertown, Mass

We published a Special Report on Machining beryllium copper (AM—Feb 10 '49, p101) *and it is interesting to note the similarity between Geo Sammet's experimental results in production and those of the author of the report.*—Ed.

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Have Threads
Rolled Exclusively on

REED MACHINES

COMPLETELY AUTOMATIC

Reed machines roll threads on the thin wall of spark plug shells with electrode already welded in place. Threads must be square with shoulder on part.

Rolled threads are superior. They are uniformly accurate, smooth and stronger—also more economical to produce.

Reed machines, used for both thread and form rolling, are made in 2 die horizontal and 3 die vertical and horizontal types for infeed or thru-feed rolling. They are rugged, of compact construction, easy to set up, convenient and simple to operate.

Equipped for manual, semiautomatic or fully automatic feeding, Reed machines are suitable for both small job lots and large production runs.

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197

new Starrett HI-PRECISION micrometer
reads direct in ten-thousandths

Only with this new Starrett No. 221 HI-PRECISION Micrometer do you get direct readings in ten-thousandths of an inch plus automatic spindle pressure control.

It eliminates reliance on "feel" . . . gives every craftsman the measuring skill of an experienced gagemaker. It's an ideal mike for machinists, inspectors . . . anyone who has a micrometer more or less constantly in hand.

When you want the best in precision measuring tools, you think instantly of STARRETT. It's the name that means quality, dependability, accuracy beyond question. Did you know that among the more than 3,000 Starrett products there are many other items you buy or use every day? Starrett dial indicators, steel tapes, hacksaws, hole saws, band saws, band knives and precision ground die and flat stock are all available through the same convenient source of supply . . . your INDUSTRIAL SUPPLY DISTRIBUTOR.

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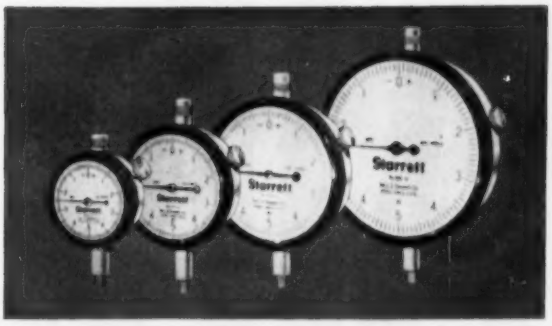
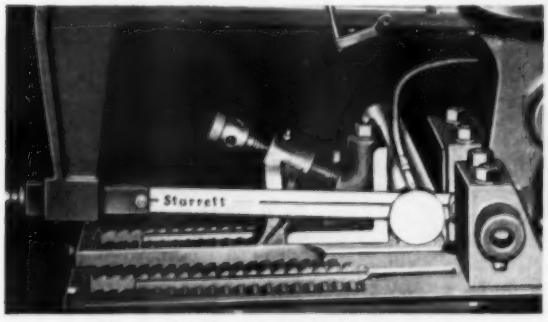
NO. 167 STAINLESS STEEL RADIUS GAGES

Made of stainless steel — rustproof and stainproof — satin no-glare finish. Each gage has five gaging surfaces for convex and concave radii. Available in six convenient sets in plastic case. Handy gage holder also available.



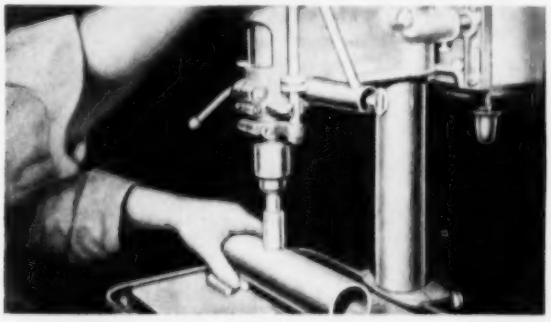
NEW HIGH-PRECISION, LOW-FRICTION INDICATORS

In standard AGD indicators Starrett offers 140 new models. All No. 25, No. 655 and No. 656 Regular and NONSHOCK Indicators have identical, *interchangeable* gear mechanisms. Any gear unit and any case assembly can be quickly combined.



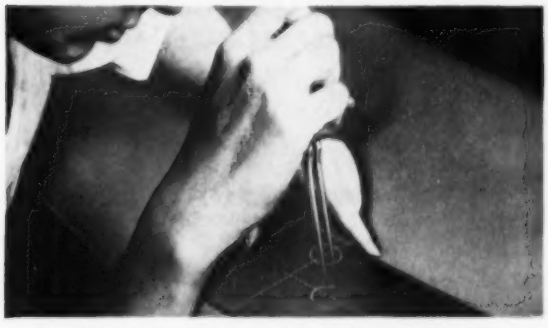
NEW PRODUCTION-PROVED HACKSAWS

Production-proved to give you better cutting performance, longer blade life . . . color identified to help you select the right blade for any job. These new Starrett faster-cutting, longer-lasting hacksaws are now available through your Industrial Distributor.



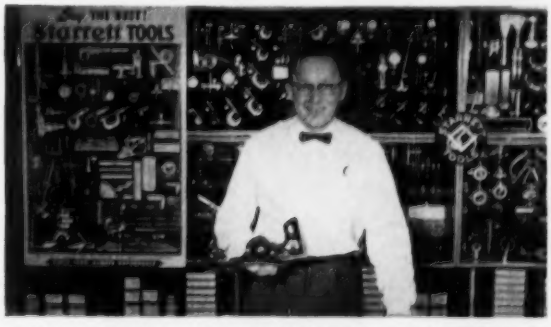
NEW SAFE-FLEX® HOLE SAWS

New double-welded, shatterproof hole saws for cutting large diameter holes in metals, plastics, wood. Interchangeable arbors hold wide range of saw sizes. Shanks fit portable power tools, lathes, drill presses, etc.



DIE AND FLAT STOCK — NOW OVER 1000 SIZES

Precision ground to Starrett standards of accuracy. Available in oil, water, oil and water or air hardening types. A great time and money saver. "Just lay it out . . . and saw it out" to save valuable man and machine hours.



AVAILABLE THROUGH YOUR INDUSTRIAL DISTRIBUTOR

You get quality beyond question from a convenient and reliable source of supply when you buy Starrett Tools through your Industrial Supply Distributor.

BIG NEW CATALOG NO. 27

New No. 27 Catalog describes and illustrates the complete Starrett line. Ask your Industrial Distributor or write for free copy. Address Dept. C.

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SINCE 1880
WORLD'S GREATEST TOOLMAKERS

HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

AIR LIFT

Faster! *Safer!*

DOUGLAS AIRCRAFT uses ARO Link Chain Hoist in tooling shop at their Santa Monica plant. Shown here, bulkhead fixture being lowered onto flat car.

NEW LINK CHAIN AIR HOIST!*

***ROLLER CHAIN ALSO AVAILABLE—ALL MODELS**

NEW Link Chain Hoist now added to the popular ARO line . . . up to 1000 lb. jobs!

VARIABLE SPEED . . . 0 to 38′ per minute . . . load can be inched or zipped.

AIR-POWERED FOR SAFETY . . . no spark hazard . . . explosion-proof motor . . . can't burn out or overheat . . . unaffected by dust or fumes.

LIGHTWEIGHT . . . only 29 lbs. . . . overall length 10½″. Can be converted to Roller Chain type if desired.

Also available, Roller Chain Hoists—2,000 lb., 1,500 lb., 1,000 lb., 500 lb., 300 lb., 100 lb.

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Spot news...

- **Russia is reported ready to buy British machine tools** that may add up to 500 units costing $75-100 million. Russian trade delegations have been visiting British machine tool plants following intensive inspection of machines on display at the Olympia Show. Soviet representatives have visited the works of Sentinel (Shrewsbury) Ltd three times.
- **Seminars on machining and machinability computers** will shortly be started by GE's Metallurgical Products Dept (formerly Carboloy).
- **Boeing has completely converted to manufacture of jet aircraft** as of July 18, when its last piston-powered Stratofighter rolled out the doors of its Renton, Wash, plant—minutes ahead of its first production jet transport.

First U S laboratory for instruction in shaped diamond tool technology is being set up at Illinois Tech under a $30,000 grant from South Africa's Industrial Distributors Ltd. First courses for industry start September 17, will cover diamond selection, sawing and shaping diamonds for tools, turning, boring, wheel dressing.

- **British have achieved surface finish of three-quarters of a millionth rms** on a standard Jones & Shipman 10 x 27-in. universal production grinder using a Carborundum 463K/5V grinding wheel at 1750 rpm on HRS oil-hardened to 60-65 Rc. Work speed: 210 rpm. Initial cut removes 0.0002 in. Inching mechanism does the finishing grinding.
- **Cadillac's top-line super-deluxe Brougham (lists at $9000)** has suffered another introduction delay. Now it won't be out until "sometime in February of 1957"—missing the National Auto Show in December.

Look for a more favorable Washington attitude toward fast tax writeoffs on new plant and equipment. Reason: its chief opponent, Treasury's Humphrey, had to promise a loosening of the tax reins in exchange for steelmakers' cooperation in bringing the steel strike to a close.

- **ODM's top policy post affecting metalworking industries,** Assistant Director for Production, has just gone to George B Beitzel, ex-president of Pennsylvania Salt Mfg Co, who has been making a study of the domestic watch industry for the Office of Defense Mobilization.
- **Major gas-turbine production program will shortly be launched** by Solar Aircraft Co, San Diego, Calif. Under contracts totaling upwards of $2.6 million from the Air Force and Boeing, Solar will turn out airborne generator sets and auxiliary gas-turbine installation kits.
- **Japan has taken another major step toward jet plane manufacture** with develment of the J3-1 axial-flow jet engine. Now under test, it's made by the Japan Jet Engine Co and four other firms, assembled at Fuji Heavy Industries. If it's successful, the J3-1 will go into Japanese jet trainers.
- **Chrysler's now-idle San Leandro, Calif, plant may be bought or leased** by Boeing for its long-range missile program.

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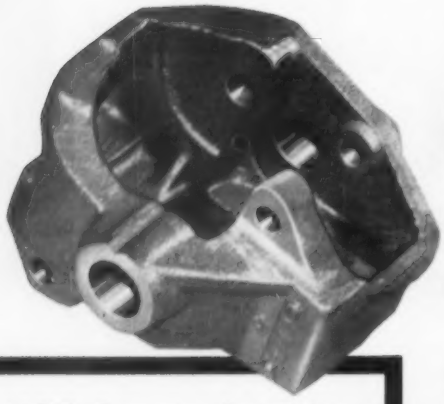
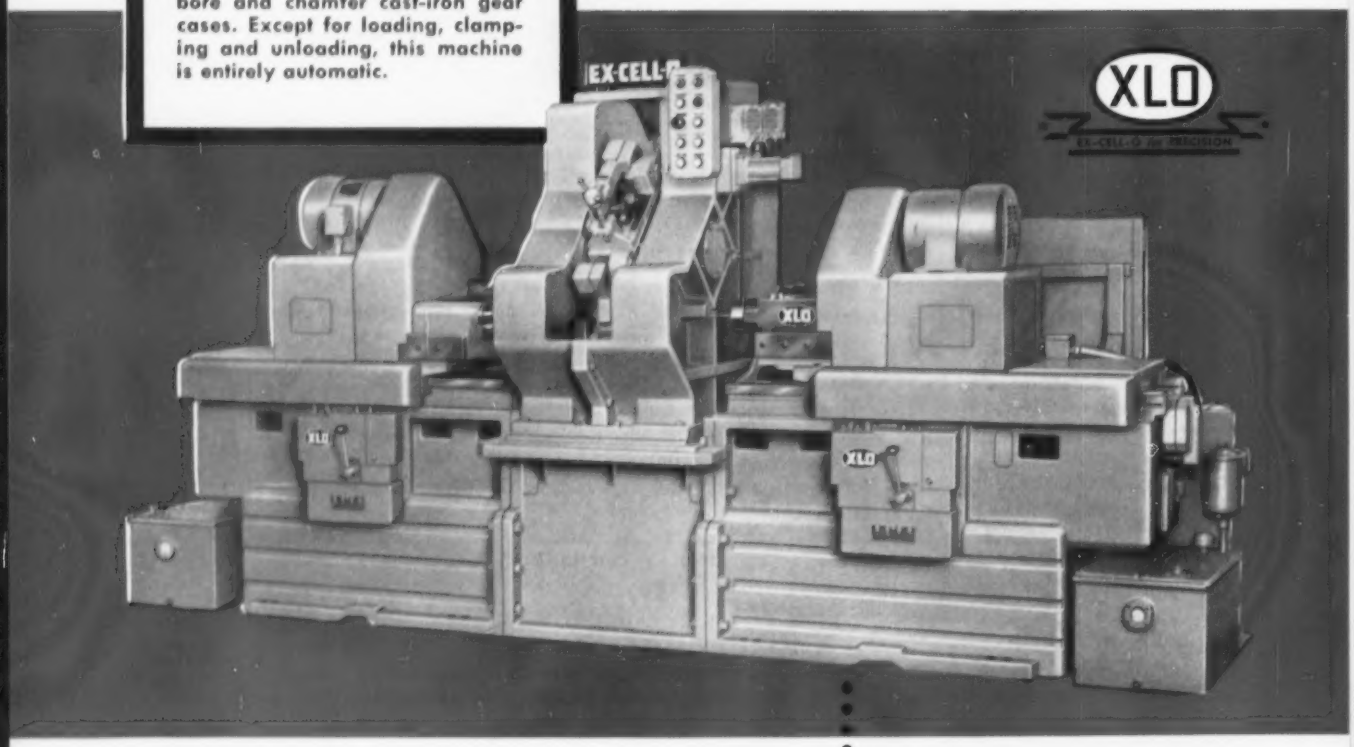


New Ex-Cell-O 2-Way Machine

speeds gear case production, lowers cost . . .

ABOVE: Gear case after machining. Hole sizes are held within .0005", centers .001".

BELOW: New Style 54-A Precision Two-Way Machine equipped to bore and chamfer cast-iron gear cases. Except for loading, clamping and unloading, this machine is entirely automatic.



Typical of Ex-Cell-O's constant improvement in the field of precision production is this new Style 54-A Two-Way Precision Boring Machine.

Operations on the cast-iron gear case illustrated include finish boring seven holes and chamfering diameters at two points. With its new hydraulic control panel each way unit has a greater range of feeds and a higher rate of rapid traverse.

Like all standard Ex-Cell-O Machines, the new 54-A is easily adapted at slight cost to a variety of precision setups. For further information, contact the Ex-Cell-O representative in your area, or write, wire or phone direct to Ex-Cell-O, Detroit.

56-25

EX-CELL-O

CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Washington ... NEWS REPORT

Another "new look" in defense . . .

Big military manpower cutbacks are in the offing—up to 800,000 men out of the present 2.9-million-man force within the next four years. Plans stem from a major reappraisal of US military policy now being made by the Pentagon. This latest "new look" is aimed to project military requirements through 1960. Object is to exploit latest technological advances even more intensely than now, reduce manpower needs as much as possible.

Up to two months ago, the belief was that the size of the military forces would be maintained at present levels. But now there's talk of future manpower reductions. Two reasons are behind the move:

- Manpower cuts are seen as the only way to hold down expenditures. Defense costs are rising rapidly, including personnel. For instance, it costs the Defense Dept as much to maintain 2,850,000 men in uniform now as 3,400,000 three years ago.
- To a great degree, lesser numbers of men are needed because of new super weapons. Even without nuclear weapons, the Army division of today, for example, has 85% more firepower than the World War II division. Add nuclear warheads and you have a quantum jump in firepower efficiency.

Added to these factors is the increased feeling that a future war will be decided in a hurry—with little chance of a prolonged mobilization in which conventional equipment would be brought to bear.

Reflecting these developments, Great Britain is considering a one-third cutback in its defense budget, reductions in ground forces, and de-emphasis of tactical air forces.

The US won't go that far. Indeed, our defense budget is slowly inching up—from $35.6-billion expenditures in fiscal 1956 to at least $36.1 billion this year. The new manpower reduction proposals are aimed to keep defense spending within the $36-billion range. Result of the new policy will be to shift even more sums from ground forces to Strategic Air Forces—heavy bombers, tankers, long-range missiles—and to the Air Defense System—interceptor fighters, anti-aircraft guided missiles, radar, and other electronic gear.

Congress probes aircraft profits . . .

The Hebert Committee's report on its investigation of profits on military aircraft contracts makes no specific recommendations for policy changes (see p166). But though no new legislation is coming out of the probe, it's likely the Pentagon will bear down somewhat harder on procurement. More uniform standards on negotiated contracts are being studied, based on a weighted average of returns on both sales volume and private capital invested. In addition, there'll be tighter restrictions on the amount of overhead charges—executive bonuses, advertising costs, corporation contributions, and the like—that can be charged off as operating costs by firms which do the bulk of their business with the government.

New Navy shipbuilding program . . .

The Navy has outlined its fiscal 1957 shipbuilding program. Major construction assignment is the sixth Forrestal-class super aircraft carrier, to be built in the Navy's own New York shipyard. This is in line with statutes providing for alternate assignment of major warships of specific types to private and government shipyards.

This is what private yards will handle: Bethlehem's Quincy yard—a nuclear-powered guided missile cruiser, and conversion of a conventional-powered light cruiser to guided missiles; Bethlehem's San Francisco yard—another light cruiser conversion; New York Shipbuilding Corp, Camden, N J—conversions of a missile light cruiser, and an amphibious assault ship; Newport News Shipbuilding—conversion of an attack aircraft carrier.

Up to now, almost all ship conversions have been handled in Navy yards. Policy now is to train private yards to get in on this program.

Still to be awarded this year—on a competitive bid basis—are construction of 4 nuclear subs, 8 guided missile destroyers, 2 guided missile frigates, 2 escort vessels, 3 ammunition ships, and more than 1000 landing craft.

BDSA's new executive reserve . . .

Commerce Dept's Business & Defense Services Administration has named almost 100 industry executives—including prominent metalworking officials—to its executive reserve. This is a group of private industry men lined up in advance to take over top-level government mobilization slots in case of a national emergency.

Recruiting is aimed only at executives who held down mobilization jobs before. If you want in and still haven't been invited, write to Charles Honeywell, BDSA Administrator, outlining your industry and government background.

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Official Photograph UNITED STATES NAVY

PRECISION PERFORMANCE...

To the U. S. Navy's famed Blue Angels Flight Demonstration Team, precision performance means split-second timing when demonstrating their thrilling maneuvers in formation flight.
To tap users, precision performance means production-line continuity, better threaded parts, increased tap life . . . and BAY STATE!

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Mansfield, Massachusetts

On the shelves of your local Industrial Supply Distributor

Detroit ... NEWS REPORT

As 1956 closes out . . .

As the unlamented '56 model year heads into its final weeks, auto sales people are shrugging off a slumping market and looking ahead to the new models with a gleam in their collective eye.

The upcoming '57's are expected to lift a sagging market by the seat of its pants and shake it hard. That's going to mean a real production about-face. This month, production will be slashed 20% on closing-out '56 lines—zooming to an anticipated fourth quarter boom as the glossy new lines hit the salesrooms.

There's some justification for sales managers' hopes. Even though there's a current axiom in Auto Row that yearly changes are "evolutionary, not revolutionary," stylists have come up with a '57 product in almost all lines that will stimulate a lot of refiguring of household budget money. The new cars are going to be hard to resist—so much so that the industry hopes to be able to forget the fiasco of 1956 in short order.

When will the '57's be out?

Firm dates for the introduction of '57 models are hard to pin down so far. Best educated guesses as to introduction dates run about like this:

- GM will start showing in the third week in October, will wind up introductions by November 9.
- Ford will begin earlier—about October 5 for the Ford Division—and will be all through by November 1 with one exception. The Continental Mark II will have just a few running changes and they'll come along in mid-September.
- American Motors will show all its new models on or about October 20.
- Chrysler will start introductions in the last week of October, through to November 5.
- Packard very probably won't show a production model at all, but may come up with a hand-made job at November's end. Studebaker is promising to get its new line out about the end of November.

New tooling wrinkle . . .

Although tooling for the '57 models is still a long way from completion, an additional source of tooling revenue will be along soon.

It's called "side gating," or "gate lining"—a system of body assembly that one engineer defines as "bringing the mountain to Mohammed." Already in existence on some of GM's production lines, and in the offing for at least one other of the Big Three, this is how side gating works:

A movable truck, equipped with an enormously heavy, precision-built base plate, moves in a closed-circuit production line. At the beginning of the circuit, a floor pan is mounted on the truck's base plate with dowel pins. Then, as the truck makes the circuit, body components are tack-welded onto it.

The name "side gating" comes from the massive jigs that support the sides of the auto body until it builds up enough structural strength to allow it to be transported for final welding.

Principal advantage of the system is the flexibility it permits in switching body styles on a basic production line. That's why automakers are favorably inclined toward this method—even though tooling expenses are heavy.

Things to come . . .

The no-draft window ventilator is dying a lingering death after some two decades. Already reduced to a tiny wedge on most '56 cars, the no-draft window will be even smaller on the '57's, will probably disappear altogether by 1958. In fact some makers would have liked to have dropped no-draft altogether in the 1957 models, but decided to give it one more year.

Air conditioning is the hottest topic in Detroit. Even the die-hards now admit the industry is headed toward universal air conditioning. The prediction is that in less than five years air conditioning will be as prevalent as auto radios are today—and they're in four out of five cars.

This could affect parts makers drastically: engineers agree that air conditioning is useless if car windows are opened, but they also know Americans are "open-window conscious." The solution: seal car windows so they can't be opened.

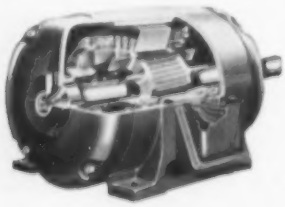
And that means no window regulator guides. Ergo, you can have the stylists' dream of a car with "flush glass."

Just to show how far thinking has gone along these lines: engineers of the Big Three are playing around with a gimmick that let's you talk to someone outside the car without opening a door or window. It's an under-the-dashboard-mounted hand mike that operates through your car radio to a speaker located behind the radiator grille. And as a forerunner, some '57 models will feature a speaker mounted outside the car body "for use on picnics."

TWO WAYS...with Master Unibrakes

STOP-HOLD—Master Type M Magnetic Unibrake Motors. For quick, controlled stopping—especially when you want to hold the load. Spring-setting magnetic release brakes of the friction disc type combine with motor in a compact, integral unit. Sizes—⅛ to 150 H.P.

ROLLING STOP—Master Type D Dynamic Unibrake Motors. Braking is obtained with a unique, patented brake winding superimposed on the stator winding. Simple, compact, with no DC current required, the brake has no moving parts. There is nothing to wear or adjust—braking torque repeats consistently. Particularly recommended for automatic applications which do not require static holding. Sizes up to 30 H.P.



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MASTER UNIBRAKE MOTORS

Machine tools ... NEWS REPORT

Engineering work grows . . .

Seeing that engineering keeps ahead of production is a major headache of many machine tool builders.

One builder reports that engineering is his biggest problem. This stems from the amount of special tooling, including automatic loading and unloading devices, demanded by customers.

Another builder is trying to keep up with his engineering requirements by farming out quite a lot of the work.

What with the tailor-made specifications laid down by users today, there is something special on almost all machine tools. The result is that the engineering work to be done by the individual builder is more likely to increase than decrease as time goes on.

The lack of skilled help and the high price of it when available are two problems bothering some machine tool companies.

Working capital thin . . .

The need for more working capital to bring it within the range of expanded business requirements overshadows all other problems with some builders.

Product and plant expansions the past few years have lifted the volume of these builders onto a higher level and have left them with a very thin working capital position.

One builder has helped to solve the problem by issuing preferred stock that up to recently was authorized but unissued. Another builder is about to put out a new issue of common stock, thus acquiring more working capital without resort to bank loans.

Two shifts overtime . . .

Faced by huge backlogs, most machine tool builders are working long hours and multiple shifts.

Workweeks of 50-55 hr are not uncommon. Some are operating on two 10-hr shifts Monday through Friday, plus 5 hr on Saturday.

One company has been able to shove up its production 20% by working two overlapping shifts for a total shop workweek of 80 hr. Average workweek per employee is 50 hr.

So-called "bottleneck" departments are running on Sundays in a few cases.

At least some builders are unhappy about the long hours being worked by their men, feeling that after awhile fatigue and something less than top efficiency result. They hope in some way to extricate themselves from this situation before long, but just how is the question.

More builder initiative . . .

"The machine tool industry is one of the best sources for assistance in keeping manufacturing costs down," Howard L Roat, director of production engineering for AC Spark Plug Division of General Motors, told the Machine Tool Sales Conference at Purdue recently.

He expressed concern, however, about some builders who "do not grasp new conceptions of manufacture more readily and come up with solutions."

He told how several machine tool companies had abandoned the effort to cut costs on certain jobs when they found that their presently-marketed machines could not be readily adapted to a solution of the problem. Managements of these companies should have a more open-minded attitude, he asserted.

Allied embargo may be relaxed . . .

Latest Washington checkup shows that the present ban on shipment of US machine tools to Russia and other communist countries is not likely to be eased.

Our government, on the other hand, probably will be less insistent than it has been that NATO nations continue without modification their present embargo, which is the same as ours.

This autumn US officials will meet with friendly countries at Geneva to negotiate changes in the embargo list of strategic materials and equipment.

Washington is now in the midst of working up detailed specifications for machine tools to be put on the approved list.

State Department may ask some US machine tool industry men to go to the Geneva conference as consultants.

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- Parts automatically clamped
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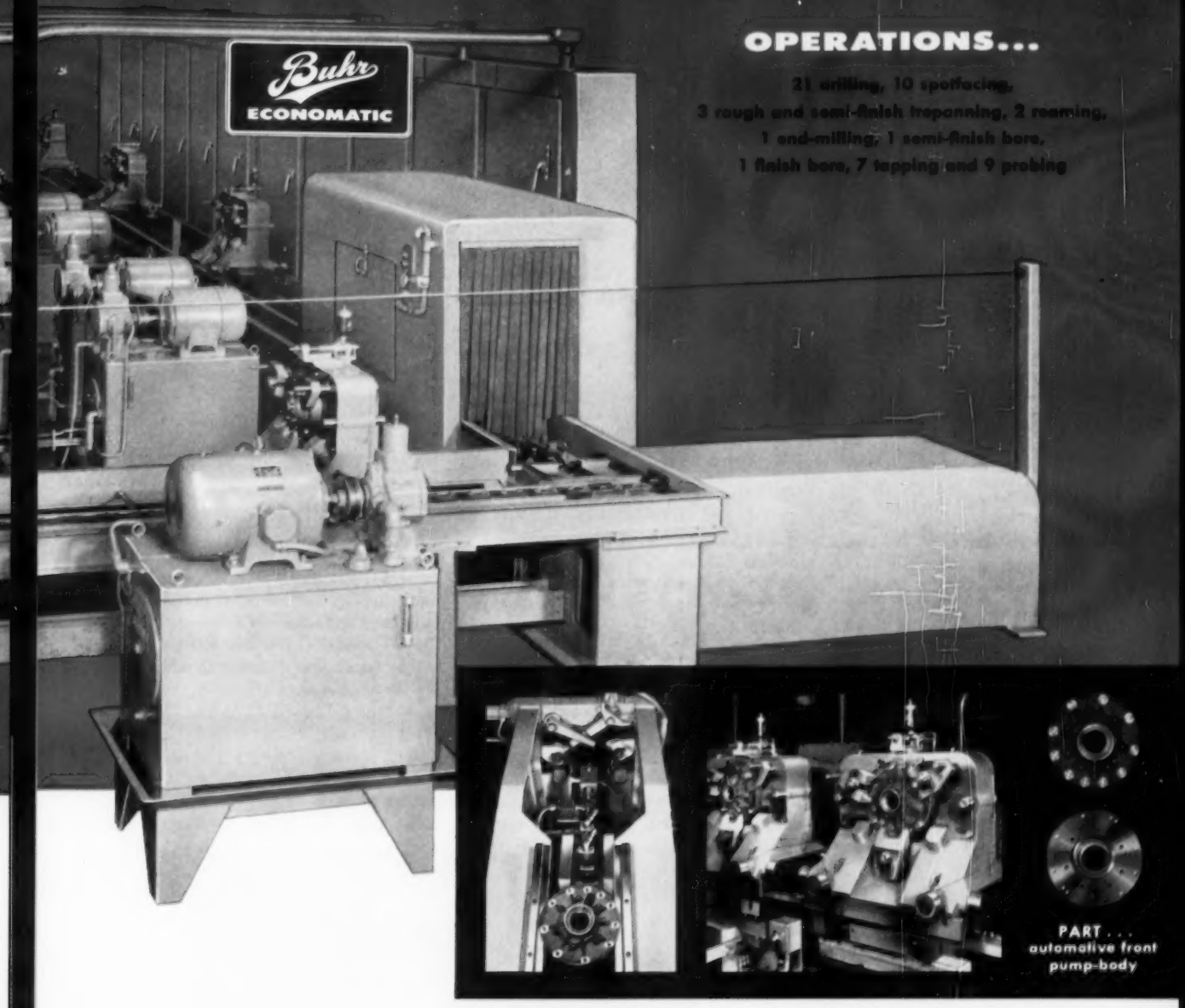
performs 55 operations every 23 seconds!



OPERATIONS...

21 drilling, 10 spotfacing,
3 rough and semi-finish trepanning, 2 reaming,
1 end-milling, 1 semi-finish bore,
1 finish bore, 7 tapping and 9 probing

PART . . .
automotive front
pump-body

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What's ahead ... in Metalworking

NEWS REPORT

Fat fourth quarter is "in the bag" ...

A whopping fourth quarter seems assured for the nation's metalworking industries, now that the steel strike is a thing of the past.

Steel production cannot be turned on and off at will as you would control a machine by a push-button. But by the time you read this page, the steel tonnage should once again be flowing freely from mills.

Some users of heavy steel items did get caught short but they are strictly in the minority. The strike settlement came before most consumers were pinched so that it hurt.

The job of getting steel production back up to full capacity is not easy. The final 10% (from 90% to 100%) will be tough. And if any open-hearths have been seriously damaged by the shutdown, it may be sometime in September before operations are satisfactory.

Most steel mills ar confident that production will tax available facilities the remainder of the year.

The boost in steel prices is causing users to groan. A portion of the added cost of manufacture will be absorbed, but most of it will be passed along to the ultimate consumer.

One major appliance maker has announced increased wholesale prices almost all along the line. The steel hike was only one of several factors cited for the action. Similar decisions are sure to be made by other companies soon.

The cost effect of the steel settlement is double-barreled. The steel contract serves as a target for unions in metalworking companies to shoot at for themselves. Labor costs of steel users are bound to go up.

Durable goods industries promise to do all right straight through the year.

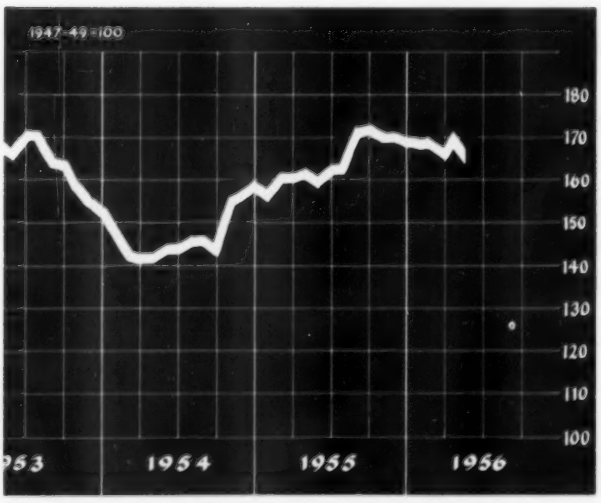
McGraw-Hill new orders for machinery stood at 155 for June (1950=100). That is down 2 points from May, up 6 points from April and up 24 points from June 1955.

Machine tool shipments this year should climb to some $900 million.

Materials handling equipment makers have been booking business considerably ahead of the record-breaking year of 1955, Material Handling Institute reports. New orders this year have averaged 143 (1954=100). This compares with 121 last year.

New orders for industrial equipment and supplies slipped a little in June, dropping to 197 from 200 in May and 208 in April. Nevertheless the dollar volume is still above the prevailing level in 1955. For June, the dollar gain over last year was 5%. Steel castings people are in the midst of one of their best years. Tonnage produced in '56 will be a good 20% ahead of last year.

Railroad car building program is responsible for a good chunk of this year's banner business. Car builders, however, have been hit harder than most users by the steel strike. They still possess high backlogs which they will be working off through most of 1957.



165

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

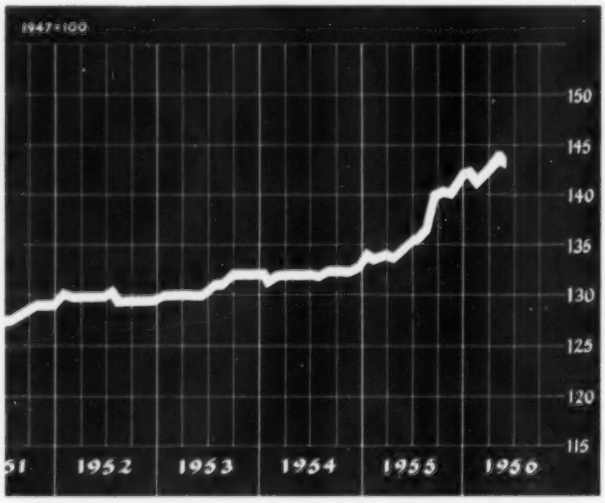
	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total Index	**165**	**167**	**167**	**163**
Machinery	149	149	149	136
Electrical Machinery	199	206	206	194
Autos	113	114	114	145
Other Transportation	330	318	318	280
Other Metalworking	137	136	136	138

NEWS REPORT

What's ahead . . . in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total Index	**144.2**	**144.0**	**143.9**	**135.1**
Metalworking Machinery	165.6	165.0		152.4
Other Machinery exc. Electrical	150.9	151.0		139.7
Electrical Machinery	142.7	142.6		131.7
Fabricated Metal Products	137.5	137.5		131.0



"It is hard to find a weak spot as we look ahead" . . .

Outlook for industry in general—not just Metalworking—is brighter than ever. This feeling arises from the steel settlement, which seems to have set into motion an expanding activity in both industry and business.

Expectation now is for higher output, sales, employment, rising prices.

The soaring spirits of some economic forecasters have led them to the use of superlatives. Typical statement: "It is hard to find a weak spot in the economy as we look ahead well into 1957."

Spending promises to be very big. This applies equally well to government, industry and business, and consumers. It will be at a higher level.

Government outlay will go up faster the next nine months than in the last nine months. Much of the increase will stem from defense requirements—more and bigger planes and missiles.

State and local expenditures will go up as highway and school construction programs get underway. Spending for new plant and equipment may well set an all-time record next year, even exceeding the 1957 peak.

The inventory situation looks good. Chances are better than ever that stocks will have to be built up to keep pace with upsurging activities.

Consumer purchases will be bolstered by the increased buying power of higher wages. Volume of business in food and clothing, for instance, promises to inch up. So will residential construction, now believed at its low point for the year.

WEEKLY BUSINESS INDICATORS

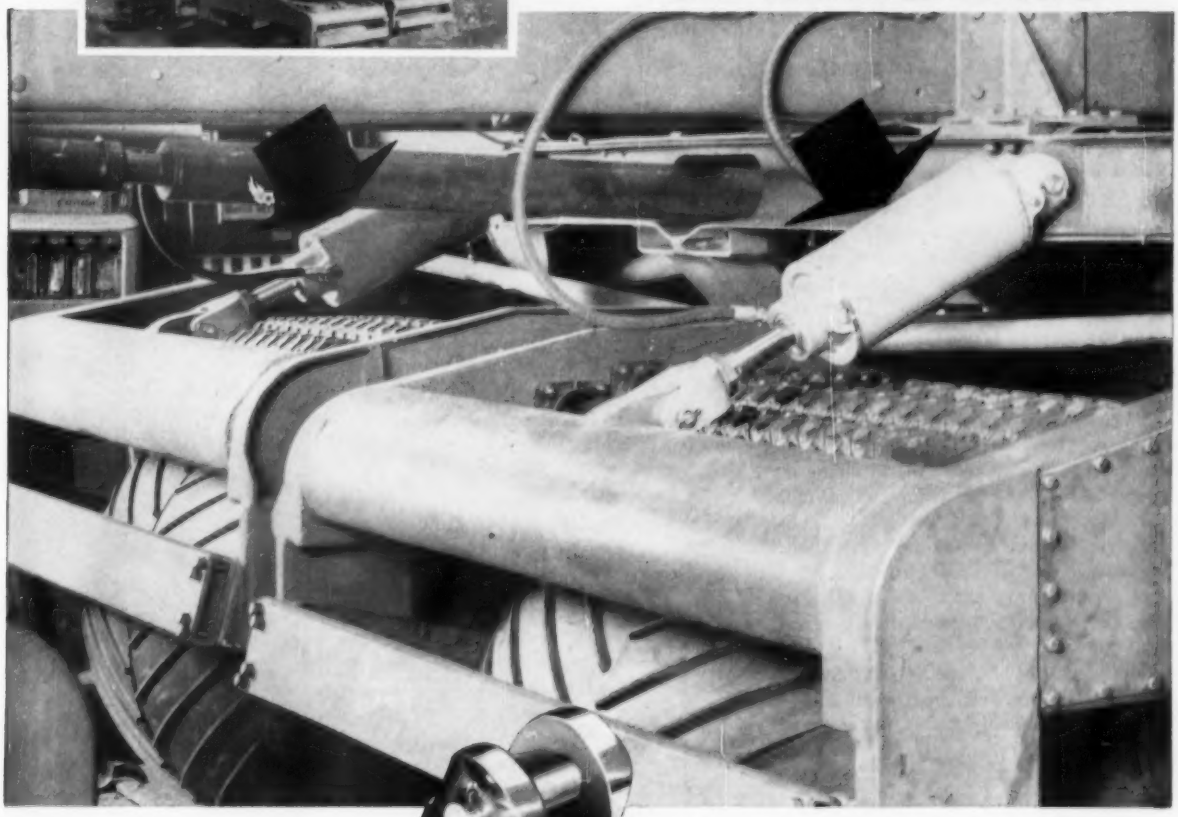
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)*	141.9	141.7	145.8
Steel ingot production (thousand tons)	431	419	2,098
Electric power output (million Kilowatt hours)	11,295	11,125	10,727
Production of automobiles and trucks	145,691	146,948	199,760
Engineering construction awards (Eng. News-Record, millions)	$309.5	$396.9	$317.7

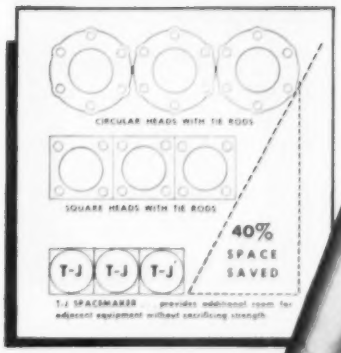
MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
McGraw-Hill Index of New Orders for Machinery	152	151	129
New contracts for industrial construction	256	251	164
Refrigerators sales (thousands of units)	328	334	390
Vacuum cleaners sales (thousands of units)	326	353	256
Washers sales (thousands of units)	315	324	342
Household electric ranges sales (thousands of units)	86	115	109
Radio production (thousands of units)	799	983	1,114
Television production (thousands of units)	468	550	467
Gear sales index (1947-49=100)	275.6	264.7	205.2
Foundry equipment new orders index (shipments, 1947-49=100)	207.0	135.2	145.7

* Seasonally adjusted.

Arctic Cargo Carrier Depends On T-J *Spacemaker* CYLINDERS





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Differential axle loading through T-J Spacemaker Air Cylinders forms a controlled walking beam in this Teracruiser, designed and produced for the Army Ordnance Corps by the Four Wheel Drive Co., Clintonville, Wis.

Weight of cylinders was important factor in choosing T-J Spacemakers, which reduce weight while providing same displacement and extra high safety factor. Fast delivery and space-saving features also favored T-J. Exclusive with T-J are new Super Cushion Flexible Seals for Air (to 200 P.S.I.) . . . and New Self-Aligning Master Cushion for Oil (to 750 P.S.I.). Hard chrome plated bodies and piston rods are standard, at no extra cost. Wide range of styles, capacities . . . 64,000 combinations *off the shelf!* Write for bulletin SM-155-3. The Tomkins-Johnson Co., Jackson, Mich.

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RIVETORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Armco 17-4 PH solves problems in valve design and production

This ball holder is a vital part of a new, high-pressure safety valve. It must hold the valve ball securely until variations in line pressure cause the ball to be ejected, thereby checking the flow of gas or fluid.

Several grades of stainless were tried, but only Armco 17-4 PH Stainless Steel had the necessary combination of extra high strength, hardness and corrosion resistance.

Problems in producing the thin-wall holder were also overcome because 17-4 PH machines readily and is so simple to heat treat.

Hardens Without Distortion or Scaling

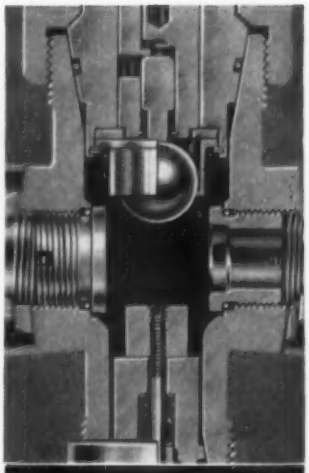
This special stainless steel is hardened by a one-hour heat treatment at 850 to 900 F. No distortion or scaling occurs. Even close tolerance parts can be finish-machined before hardening.

High Strength Plus Corrosion Resistance

In the hardened condition, Armco 17-4 PH develops a typical yield strength of 178,000 psi and a Rockwell hardness of C 44. Most other mechanical properties have correspondingly high values.

Besides unusual strength, 17-4 PH has better corrosion resistance than the hardenable grades of stainless. Under some conditions it is comparable with Type 304.

Armco 17-4 PH is available in billets, bars and wire. Another precipitation-hardening grade, 17-7 PH is produced in strip, sheets, plates, bars and wire. For full information on how these special Armco Stainless Steels can help solve your design and production problems, just fill out and mail the coupon.



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American Machinist

MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

What the Steel Settlement Means

Now that the steel strike has ended, all of us heave a sigh and say, "Well, thank goodness, that's over."

It's over, to be sure. But let's not forget that its far-reaching effects will be with us for a long time.

Suppose we look at the terms of the new contract. The hourly wage of all steel workers is to be increased 7½ cents immediately. The basic hourly rate is to be pushed up 7 cents an hour more on July 1, 1957. A year later it is to rise another 7 cents.

That is just the beginning, not the end, of increased labor costs under the 3-year settlement.

Whenever the consumer price index of the Bureau of Labor Statistics goes up from 116.5, steel workers will receive a cost-of-living adjustment of 1 cent an hour for each rise of 0.4 or 0.5 point.

Still other benefits accrue . . .

to the steel workers. S.U.B. (supplementary unemployment benefits) calls for payment by the steel companies of 3 cents an hour into a special "kitty." Another 2 cents an hour is to be contributed whenever the "kitty" is short of a specified maximum.

A new insurance agreement makes necessary the payment by the companies of 1½ cents an hour more than they have been paying for each employee. Overtime rates on holidays are to swing up to higher levels. Still other clauses in the contract spell out to an increased labor cost.

It is no surprise that, as a result of this added labor expense, steel prices have been raised substantially. And right there is where the spiraling effect starts.

Every steel user is faced by the necessity for paying more for steel. Beyond that, he will be confronted by the increased cost of every item containing steel that he buys for assembly into his product.

That's not all. The steel industry has established a pattern in "benefits" that every union in the metalworking industries will try to get for its members. The user therefore will inevitably have higher labor costs of his own, not to mention higher prices for materials and components.

The situation clearly imposes . . .

upon management a very great responsibility—to keep costs down and thereby hold price advances to a minimum. Unless that is done, inflation will get a new and dangerous lease on life.

One midwest home appliance maker already has instructed his engineers to go to work along two lines—to redesign his products to reduce the amount of steel in them and "to doll up" the products to make them more attractive to consumers in anticipation of an unavoidable hike in prices.

That approach is commendable. But it does not go far enough. Management should tackle from many angles the problem of keeping production costs down.

Howard L. Roat, director of production engineering of AC Spark Plug Division of General Motors, states the case in these words: "Creativity can be applied in lowering costs by utilization of new, less expensive materials, modern processes, better methods and improved machine tooling." He adds decisively, "At AC we consider it a 'must' to keep costs down."

Management should ask itself . . .

these pertinent questions: What are we doing to get more production per employee? Are we doing all that we can to give our employees all the possible mechanical aids to increase their efficiency? To what extent are we using the more powerful, more productive, more automatic, more cost-cutting machines now available to us?

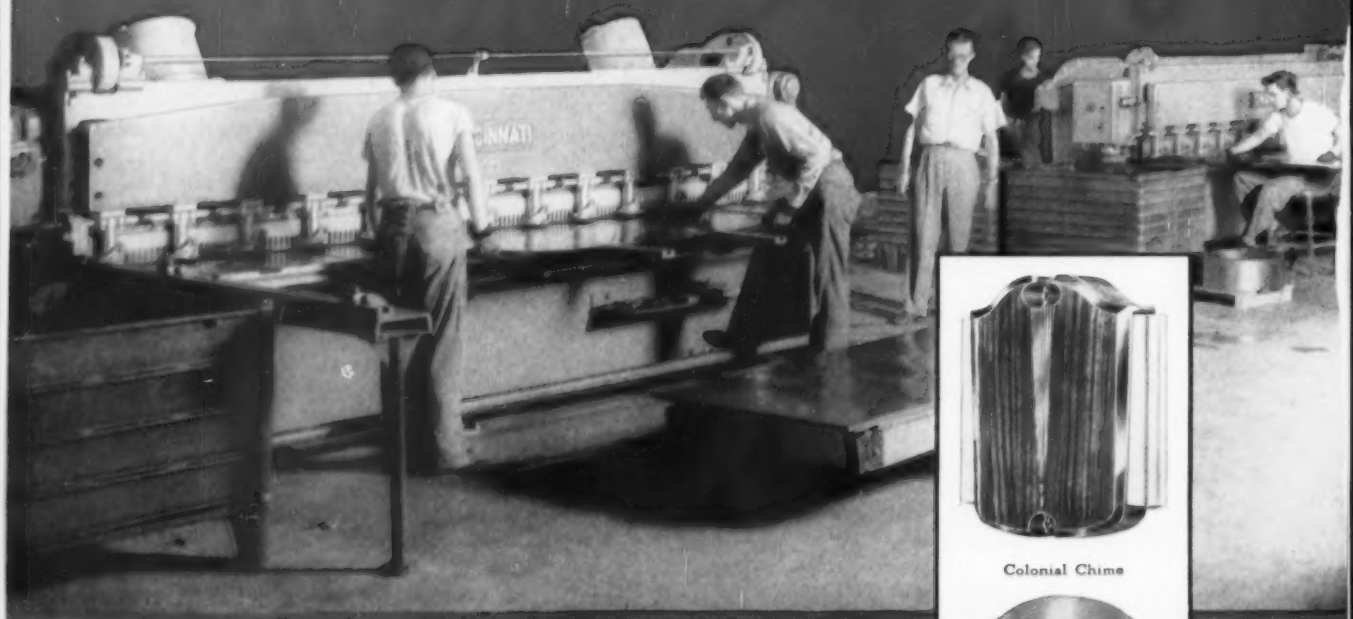
The times call for bold, far-sighted, alert management that is not satisfied to let nature take its course (and thereby get into deep trouble) but is insistent upon spending money in order to save money. Management with this point of view is Metalworking's best safeguard of our economic prosperity.

Burnham Finney EDITOR

ACCURATE BLANKS for

all these products are produced on

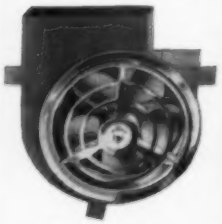
Cincinnati Shears



Photos courtesy Nutone, Incorporated, Madeira and Red Bank Roads, Cincinnati 27, Ohio.

Colonial Chime

Electric Ceiling Heater



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Accurate blanks and strip stock of many sizes are sheared on these Cincinnati Shears at Nutone, Inc. The shearing operation eliminates costly dies, is flexible, rapid and economical.

One hundred and seventy-five tons of light sheets are sheared a month. Press operations are speeded and spoilage is at a minimum. The flexibility of the shearing operations take care of new products or changes in design with no tooling or special costs. Investigate these accurate Shears.

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American Machinist

Will superalloys set production rates back 25 years?

Yes, unless we take action now to develop machines for the heat-resistant materials, says Thomas L Taylor Co, consulting engineer, Baltimore, in a study made for the Air Research & Development Command of the Air Force. Here is a summary of the findings, with suggestions for changes needed in machine tools and other production equipment

Thermal-resistant materials, now amounting to 10 to 15% of the metal poundage in airframes, are expected to reach 70% by 1965. Few of the machine tools now used in the aircraft industry can be converted economically to the machining of heat-resistant materials.

That is the conclusion of the report ARDC-TR-56-2 prepared for the Air Research & Development Command by Thomas L Taylor and Harry F Kniesche of Baltimore. Many of the machine tools particularly adapted to high speed machining of the aluminum alloys cannot be converted economically for machining the "hard" materials.

With cutting speed as the basis of comparison, the report shows that today aluminum is cut at speeds up to 1500 sfpm in general-purpose machines and 15,000 sfpm in special machines. Typical speeds for the heat-resistant materials are generally less than 100 sfpm. This drop in capability will, in effect, result in a 25-year setback in production rates.

In one plant a special machine for sculpturing wing skins removed 7075-ST aluminum at a rate of 300 cu in. per min. The same machine when working on a titanium alloy removed 1/3 cu in. per min. With titanium, only 1/10 of the available horsepower was required. The report estimates that the new material will require from 5 to 300 times the machining time required for aluminum.

Making allowance for probable improvement in cutting tools and know-how, a machining time increase of about 4 to 1 is considered realistic.

Suggested approaches (and the report's evaluation):

1. Develop a new material with the high-temperature strength required and the general working characteristics of aluminum and magnesium. (Though considered Utopian, the approach was deemed worth investigating.)

2. Develop annealing processes to produce machinable structures and hardening processes with no growth or distortion. (Not considered likely, but worthy of basic research.)

3. Manufacture parts of largest possible size as close as possible to finished dimensions by forging, extrusion, or casting. (Considered a promising approach, and test programs on the heavy presses suggested. Need for development of the large complementary machines to finish-machine the attachment points. Further research in roll forging, precision casting, and honeycomb structures of these materials should be encouraged.)

4. Develop new concepts of stock removal, such as chemical milling, electrical and ultrasonic methods, and thermo-nuclear cutting. (Development should be pushed, and exchange of information should be developed.)

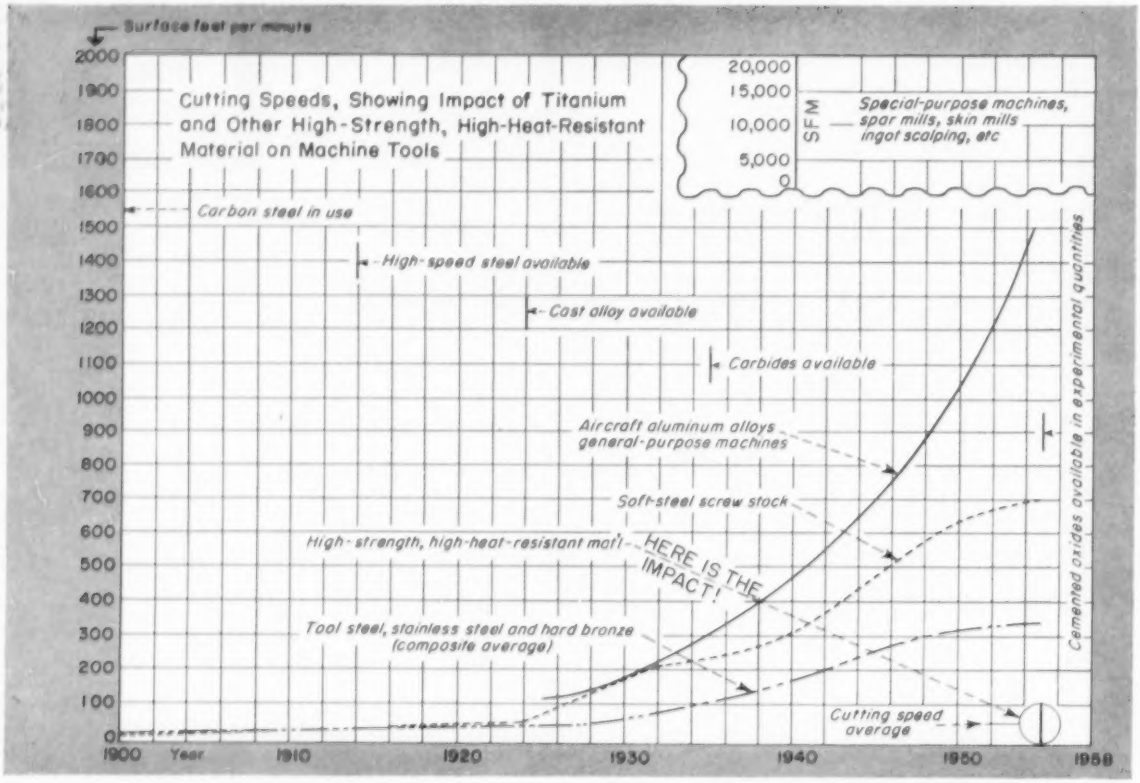
5. Development of better cutting tools and continued development of machines to fully utilize them. (Until new concepts are proved, this method is mandatory.)

INDUSTRY OPINION ON EQUIPMENT

One of the most valuable sections of the report summarizes the opinions of people in the aircraft industry on developments in equipment and methods that are needed. Highlights:

Turning and boring equipment must be more rugged. Eliminate as many joints as possible between tool and carriage. Gear trains should be eliminated and replaced with electric or fluid

Will superalloys set production rates back 25 years?



motors with speeds adjustable to suit the job.

Spindle reversal was proposed (with tool turned upside down) for these reasons:

1. Reduces danger of eye injury.
2. Tool keeps spindle against the bottom of the bearing.
3. Coolant can be applied by simple flooding.

One manufacturer suggests that future designs include a means to indicate (to the operator) machine deflection to enable immediate input horsepower correction.

Feed mechanisms are nearly always driven by gears and screw. Slight variations in speed may cause vibration of the tool. Some people feel this will materially shorten tool life when machining the harder materials.

Milling machines now outnumber turning machines 2 to 1 in airframe plants. Spar mills will have to be more rugged, with low adjustable-speed range and suitable horsepower.

Skin mills may be converted to lower speed ranges for limited production on the hard materials. Such low production rates from the converted machines, however, may make their use impractical.

Routing of large blanks in thick packs (as now employed on aluminum alloys) cannot be accomplished effectively with titanium or other hard materials. A new method must be developed to avoid sawing of single sheets or thin packs which requires filing or grinding of sheet edges.

Knee-type mills larger than No. 4 should be of rigid-base type. The knee should have some supporting means at the end, preferably from bed to knee and not from ram to knee.

All milling machines should have hardened ways (or guides) for use on the harder materials. Spindle bearings must be designed for high torsional loads at low speeds.

Each major engine plant has 200 to 300 people grinding milling cutters; they claim there has been no outstanding improvement in cutter grinders in 20 years. There is an urgent need for automatic cutter-grinding equipment.

Radial drills are all of the cantilever type and are considered inadequate for the newer materials. Needed are drills of gantry type with rugged construction and high horsepower.

All drillpresses should be sturdier, have preloaded bearings and positive feed mechanism.

Because of the tendency of new materials to work harden, thought should be given to reversing the spindle and feed for chip removal before the drill is withdrawn. For example, a drill with feed on would make 10 revolutions, then drill and feed would be reversed for 5 revolutions, then withdrawn to clear chips, then returned to pick up the former drill bite. Continuing this cycle automatically will avoid work hardening caused by tool drag.

When tapping is necessary, it will require lead-screw feeds and a better means of measuring torque of the tap shank to avoid overload and tap breakage.

Electrical discharge and ultrasonic methods need to be developed as portable tools.

Each of the major frame builders grind from

35,000 to 40,000 small drills each week working with present materials. This may increase by as much as five times when major parts are made from the newer hard materials. There is an urgent need for automatic drill-grinding equipment, on the small sizes initially, on larger sizes later.

Broaching equipment is desired by some frame builders with horizontal tables at convenient working heights and a vertical broach pulled from below. There is also interest in portable broaching equipment for assembly operations.

Mechanical punch presses are satisfactory for the new materials. Refinements of value would be better means for crosshead adjustment and quicker locking after adjustment to reduce setup time.

Principal need in *hydraulic press* forming is for rubber or synthetic pads that will stand temperatures to 1000 F.

Spot- and seam-welding equipment should have sensing or monitor controls to control slug by size and volume. If the slug size is not within tolerance, the machine should shut off.

Stretch presses will be more important. Larger, more rugged, and more powerful machines will be required. Resistance heat should be applied to the work with holding jaws isolated from the heat.

A method is needed for controlled stretching of tapered parts.

Crossheads on shears camber when cutting high-strength materials and require more stiffness.

Brakes for forming need provisions for insulating the machine from hot work that is more effective than the insulation pads now in use.

Furnaces for heat treating will need such features as controlled atmospheres for cooling as well as for preheating; heat dispersion to allow equal temperatures of hearth, roof, and sides; more effective control of temperature ranges and wider ranges (800 to 2100 F in the same furnace).

Development of satisfactory honeycomb construction of the new materials is necessary. Many plants are working on this, but unfortunately there is little interchange of information.

The increase in speed which has generated the need for heat-resistant material has also generated the need for almost perfect airfoil contours. The waviness tolerance now required on airfoils is from 0.005 to 0.010 in. in 10 in. The decrease in tolerances during the last twenty years has completely changed tooling methods of wing construction.

Many people in the industry are of the opinion that development of a machine for machining the external surfaces of a wing after complete assembly will be required in the next two to five years.

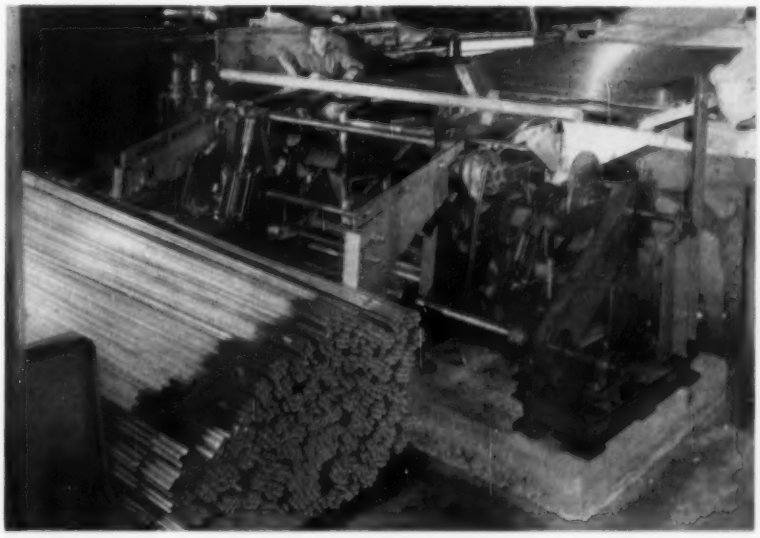
Tape-controlled machines need to be standardized as to rate of tape feed. Unless all machines in the industry capable of performing an operation have tape-control mechanisms with the same rate of tape feed for energizing the feed mechanism at the same rate of feed, interchange of job from plant to plant or machine to machine will be impossible in an emergency.

Machine bundling simplifies material handling

Savings of more than $3,500 a year are made by bundling conduit automatically with pressure-sensitive filament tape at the Spang-Chalfant Div, National Supply Co, in its Etna, Penna, plant.

Bundling was formerly a hand operation with two men using rope to tie each end of the bundles at a rate of 950 bundles per shift. Even though about 12 ft of rope were used per bundle, there were complaints about loose bundles or missing lengths of conduit.

The bundling machine, made by Guide Co, maintains a production rate of 130 bundles per hour with one operator to control the flow of conduit and load the taping heads. Conduit in 10-ft sections rolls by gravity from the inspection table into the V-shaped cradle of the machine. Number of pieces admitted by the operator varies with the size of conduit.



An air-operated clamp guides the sections into their smallest perimeter and two tape-applying heads apply three wraps of No. 880 Scotch filament tape, ¾- or 1-in. wide depending on conduit size. An average of four 360-yard rolls of tape are consumed per 8-hr shift. When the bundles are taped, cut-off knives sever the tape, the hold-down clamp releases, and the bundle is ejected onto a skid.

FEEDS & SPEEDS . . . MACHINES

. . . SETUPS . . . TYPICAL JOBS

. . . COSTS . . . COMPARISONS

. . . TOOL GRINDING

. . . AUTOMATIC CONTROL

. . . NORMAL & DEEP HOLES

. . . GUN VS TWIST DRILLS—

Here are the answers on how . . .

Gun drilling saved $280,000 +

RICHARD G SIPEL, project engineer, MILLARD T DOUGLAS, technical writer

Manufacturing Methods Unit, WATERVLIET (NY) ARSENAL, ORDNANCE CORPS, UNITED STATES ARMY

In some gun-drilling operations at Watervliet, as much as a 50% saving in machining time has been accomplished. This figure is based on machining time only; it does not include tooling and maintenance savings. One of the outstanding characteristics of this modern gun-drilling technique is that *potentially any component, regardless of size, can be drilled.*

While originally developed to produce gun barrels, with the work rotating, the term "gun drilling" no longer accurately describes the process. Modern setups hold the work stationary, in any position, and the drill is rotated. Thus, there is no practical limitation on the shape or size—or balance—of work, and the inherent quality of the drilling method makes it practical for even shallow holes. Now it is possible to produce a hole in one pass having these qualities:

1 . . Less than 0.002 in. per ft runout.

2 . . Diameter within 0.0005 in. of the prescribed dimension.

3 . . Surface finish smoother than 16 mu in., rms; frequently 5 to 10.

4 . . Production applications can be tooled to permit workmen having a minimum of operational skill to gun drill efficiently.

The first gun-drilling application utilizing a modified horizontal precision boring machine was placed in the 20 mm-receiver production line at Watervliet Arsenal in January, 1951. (*For basic procedure and more examples see Modern Gun Drilling—A Special Report, AM—May 26, '52, p 109*)

HOW IT STARTED

In 1949, three serious problems in deep-hole drilling confronted the Manufacturing Methods engineers. The part in question was a 20-mm bolt body.

1. Tool life was very poor and tool breakage was excessive.
2. Because runout was excessive, location was difficult to hold.
3. Work was rejected for lack of concentricity.

Part of the trouble, and the problem, was that the material was a high-physical steel and the work had to be held stationary during drilling. Conventionally, the hole was drilled and reamed. In some cases, especially deep holes, it was necessary to center-drill first; then follow with a second drill and finish by reaming. This was slow and rejections were high.

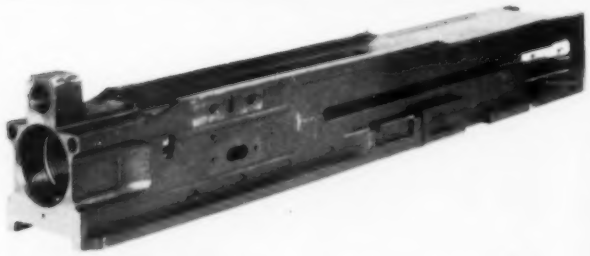
The answer to these problems was to replace the conventional method with a special gun-drilling technique. Now a variety of boring machines have been modified to permit the speeds, feeds, and coolant pressure necessary for gun drilling. Also, these modified machines are equipped with time-limit switches which provide an automatically controlled machining cycle.

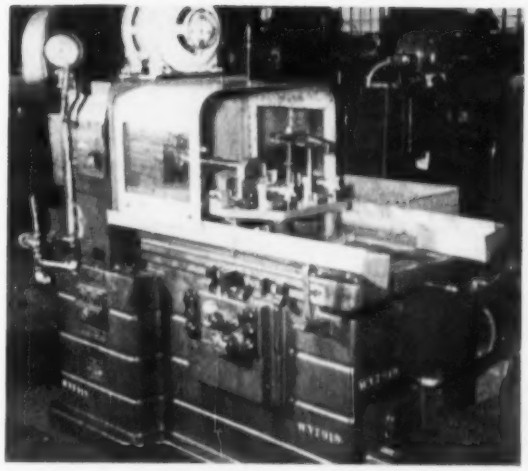
The conventional "twist drill" has been replaced by the carbide-tipped gun drill, which is entirely different in both construction and cutting action. After gun drilling, reaming is seldom necessary.

Two different makes of machine are presently being utilized for gun drilling at this Arsenal: the Ex-Cell-O precision-boring machine and the Heald Bore-Matic. (At other locations, and plants, the Bryant precision-boring machine has found favor too.)

1. The modified Ex-Cell-O boring machine (Fig 3) is of horizontal design, equipped with a hydraulic table feed, which provides a low feed range, and time-limit switches which provide a completely automatic cycle. Spindles are Ex-Cell-O model DB-22, mounted on a bridge located directly above the work table. Thus, the table can travel its full range.

Spindles are modified by drilling a $\frac{3}{8}$-in.-dia hole completely through them to permit coolant flow into the gun drill. A 1½-hp, 1150 rpm, motor drives the spindle from a bridge-mounted position directly above

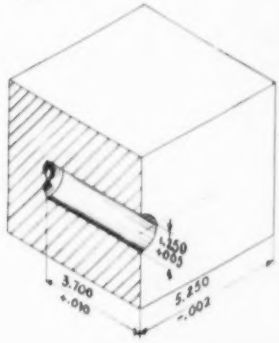


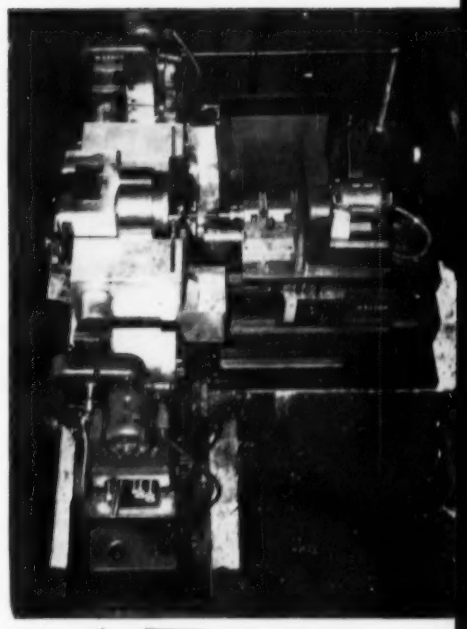


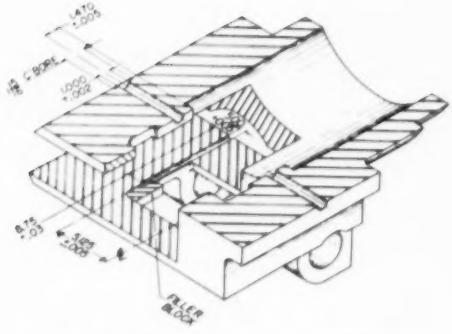
2 . . TWO PLUNGER HOLES 0.394 + 0.002 in. dia by 3 15/16 in. long are gun drilled simultaneously in SAE 4340 alloy steel. With a Brinell hardness of 270-300, gun drilling time is 9 min. Standard drilling time was 42.5 min. Saving on 3784 pc totalled $10,142.00. A 0.395-in.-dia drill was turned at 2000 rpm or 194 sfpm. Feed was 1⅝ ipm with a chip load of 0.0008 in. Coolant pressure was 325 – 350 psi and resulting finish is 63 mu-in. rms

3 . . BLIND HOLE, straight and true, is 1.250 + 0.005 in. dia by 3.700 + 0.010 in. deep in SAE 4140 at 300-325 Brinell. Location is held to 5.250 – 0.002 in. and gun drilling time in Ex-Cell-O precision boring machine is 0.25 hr. Saving over conventional drilling and reaming $875 for 622 pc. Chip load is 0.0016 in. at 230 sfpm and finish is 63 mu-in. rms or better. Hydraulic table feed provides low feed range and time switches give completely automatic control of machining cycle. Coolant pressure is 375-400 psi

at Watervliet

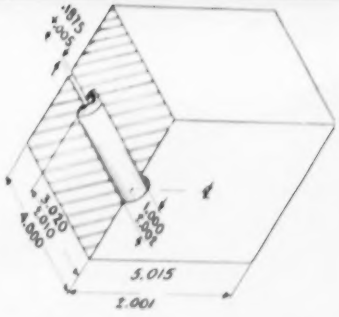




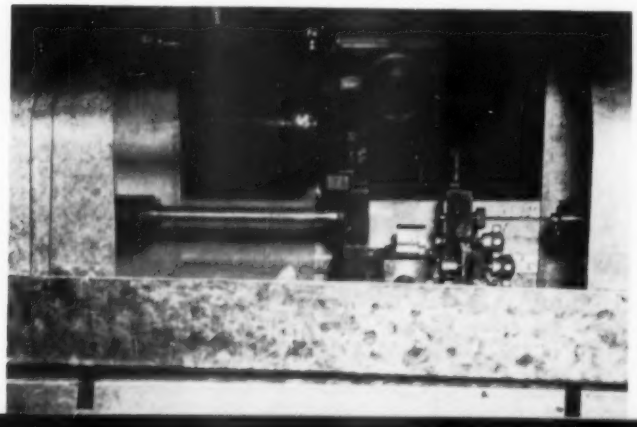


1.000 + .002 HOLES LOCATED 3.920 ± .005 BELOW TUBE BORE CENTERLINE AND .500 + .005 HOLE LOCATED 8.825 ± .010 BELOW TUBE BORE CENTERLINE

4 . . THREE-WAY MACHINE drills three holes simultaneously in a setup for gun drilling proved more efficient even though holes are relatively shallow. Two holes are 1.000 + 0.002 in. dia by 5⅜ in. deep and one hole is 0.500 + 0.005 in. dia by 8 in. deep. Material is SAE 4140 at 300-325 Brinell. Work is fixtured centrally and three Ex-Cell-O spindles advance from both sides and the rear to drill. Sheetmetal and plastic hoods confine flying chips and coolant. Simply pressing button starts automatic cycle. Gun drilling saved 11.4 hr per pc over conventional drilling; saved $12,674.52 on 342 pc. Chip load is 0.0004 in. on ½-in.-dia holes; 0.0005 in. on 1-in.-dia holes. Coolant pressure is 300-325 psi and finish in holes is 63 mu-in. rms. Generally speaking, coolant pumps for gun drilling require more horsepower than the actual cutting tool



5 . . TWO CONCENTRIC HOLES are drilled from opposite ends of the piece in this double-drill setup. Cycle is timed to automatically retract 0.1875-in.-dia drill, after it has finished cutting, before 1.000-in.-dia drill reaches full depth. Separate bushings guide each drill. Total drilling time is 0.33 hr and saving over conventional drilling is above $2.00 per pc. Coolant pressure is 550-600 psi. Chip load is 0.001 in. on the large hole; 0.0005 in. on the small hole



it. The spindle adapter is designed to fit the gun-drill driver (Fig. 13).

2. The Heald machine is basically the same; uses a Heald "Red Head" spindle which is modified and mounted in the same manner as the Ex-Cell-O spindle. However, this spindle is driven by a hydraulic-feed motor through a transfer case.

A typical gun drill consists of a carbide-tipped, or solid-carbide, cutting head, a tubular driver shank of required length, and a driver, all of which are attached by brazing. A coolant passage is provided through the entire length of the drill unit. Coolant-lubricant under pressure passes through the drill and back-flushes chips through a single flute in the drill.

DRILL SPECIFICATIONS:

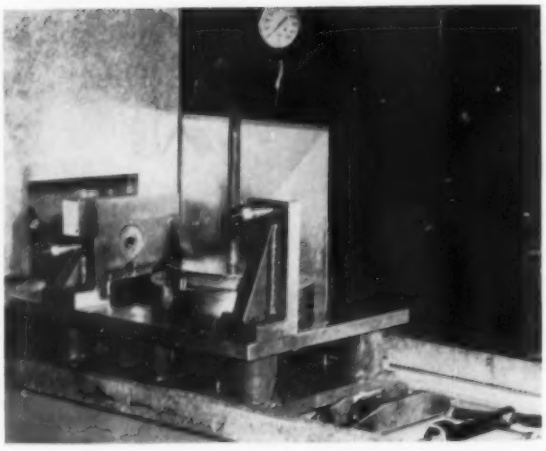
(1) Drill-tip diameter must be the basic hole diameter plus one-half (½) the machining tolerance with a minus 0.0002 in. manufacturing tolerance.
(2) Flute length equals the depth of the desired hole plus the length of the drill bushing, plus 1½ in. to allow for chip removal and regrinding.
(3) Drills in diameters greater than 0.600 in. have inserted-carbide tips; smaller dia are solid carbide.
(4) Drivers must be 2½ in. long and must have a diameter which exceeds the gun-drill diameter by:

Drill dia (in.)	*Driver dia (in.)*
0.250 - 0.625	0.6875 minus 0.001
0.625 - 0.937	1.000 " 0.001
0.937 - 1.1875	1.250 " 0.001

(5) Drivers for drills larger than 1.1875 in. have diameters in proportion to drill diameter.
(6) The drill tip and wear pads (or bearings) must be of edge-wear-resistant carbide.

FIXTURES FOR GUN-DRILLING

In applications where the work is stationary, careful consideration must be given to the drill-guide bushing, which *must be held flat* against the work face to be gun drilled. To assure accurate work, rigidity and alignment must be maintained. The starting bushing determines, initially, the direction of the hole.
Specifications for guide bushings:
(1) The ID of the bushing must be equal to the basic hole diameter plus one-half (½) of the work machining tolerances plus 0.0002 in. manufacturing tolerance.

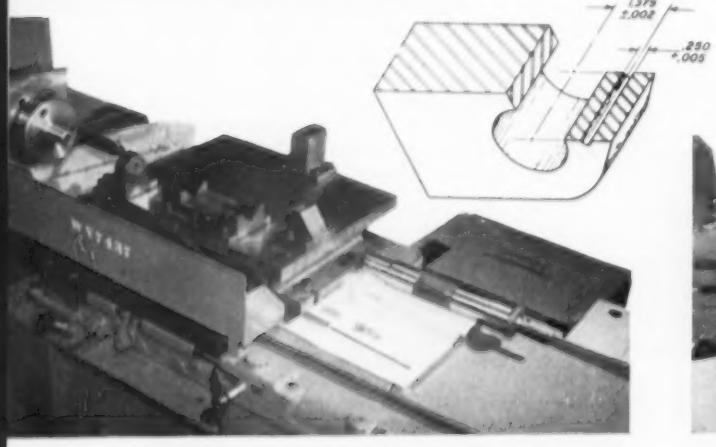


6 . . LOCKING-KEY HOLE is drilled in this simple setup. Key hole is 1.000 + 0.002 in. dia and 4⅞ in. deep

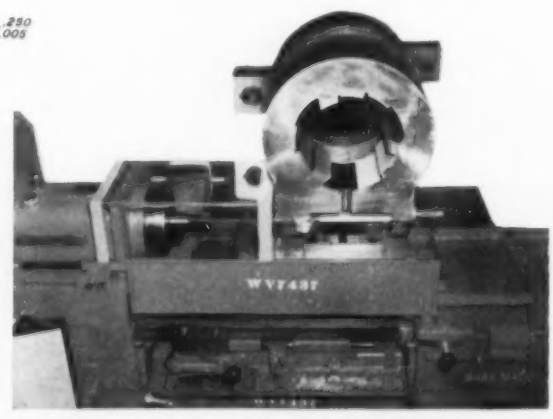
When the bushing wears beyond 0.0005 in. oversize, it should be discarded.
(2) The inside length, dimension "A", of the straight zone in the guide bushing (Fig 14) must be equal to nearest fractional dimension of gundrill diameter.
(3) To permit easy entrance of the gundrill, the guide bushing should be ground with a diametral taper of 0.0015 in. per in. as shown (Fig 14).
(4) The work end of the guide bushing must be ground as shown (Fig. 14) to assure a tight, flush, fit of the bushing against the work. This fit is necessary to prevent coolant leakage and chip jamming or clogging between bushing and work.
(5) To minimize friction, and wear, some bushings are mounted in a precision needle bearing and rotated with the drill. However this is seldom necessary, especially when work is stationary.

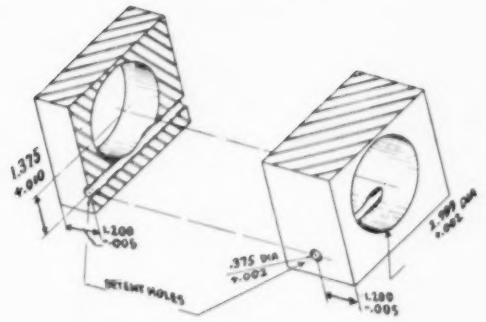
COOLANT SYSTEM AND COOLANT

A high-pressure system is necessary for gun drilling. Cutting oil, usually with less than 1% sulfur (Fed Spec VV-L-791), for holes over ¼-in. dia, is fed through a hole in the spindle and drill to the work.

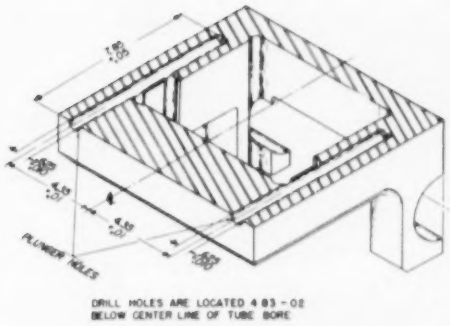


7 . . NO HOLD-DOWN CLAMPS are necessary to gun drill a 0.250 + 0.005 in. hole 2 in. long in this piece. Part is hand held on fixture and drilled at 195 sfpm with 0.0004 in. chip load. In SAE 4140, 270-300 Brinell, drilling time was cut 50% to save $1047 on 850 pc. Hole location is ± 0.002 in. or better





8 . . INTERRUPTED CUTS are readily drilled, provided the drill has a bearing surface to act as guide. Both operations shown, breech ring plunger and detent holes, are done on a modified, multi-spindle, horizontal boring machine by inserting a filler plug in the larger hole, which acts as a bearing surface for the drill. Thus, proper location and alignment are maintained. The plunger holes need no filler plug because the area of the exposed drill, in passing through the hole, is less than one-half the diameter of the drill. When it is necessary to completely expose the drill, such as when passing through the center of a larger hole, a bushing can be inserted in the fixture, on an arm or plug

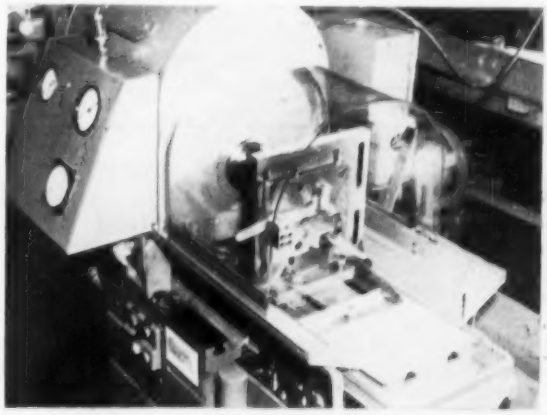


Pressure and viscosity vary according to the diameter of hole to be drilled and the drilling speed. Holes under ¼-in. dia are best drilled with a fluid having a viscosity range of 60 - 100 Ssu.

For small-diameter holes in high-physical alloy steel, pressure should be 500 to 600 psi. Pressure is reduced to 300 to 400 psi for larger-diameter drills. In all cases, pressure must be controlled because too great a pressure will cause the drill to wander or deflect and too little pressure will permit the chips to clog in the work; perhaps cause tool breakage.

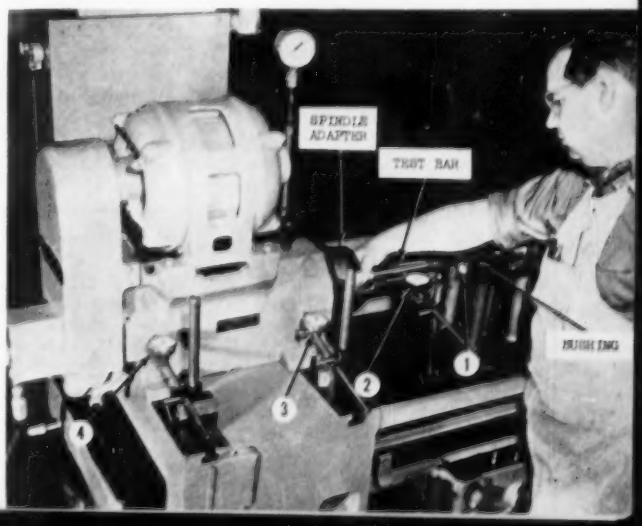
Coolant is supplied from the machine reservoir through a model SMD Cuno filter (1). A Brown & Sharpe geared pump (500 series) is mounted on a plate and driven by a 5-hp motor at 1140 rpm (2). Pump model and motor vary with the number of spindles working and drill size. Pump supplies coolant through Vickers regulating relief valve in a range of 75 to 1000 psi (3). Pressure gage (0 to 1000 psi), with a snubber is mounted on the machine visible to the operator (4). Hand-operated shut-off valve controls coolant while checking machine cycle (5). Flexible, high-pressure, ½-in.-dia hose connects coolant supply line to spindle (6). Coolant seal at rear of spindle is Fawick-Rotor-Seal, style "B" (7). Standard 1½-in.-dia pipe connects machine reservoir to pump and ¾-in.-dia pipe connects pump outlet to shut-off valve (8). Constant flow, at pressure, is essential.

Adequate chip guards and chutes are essential as

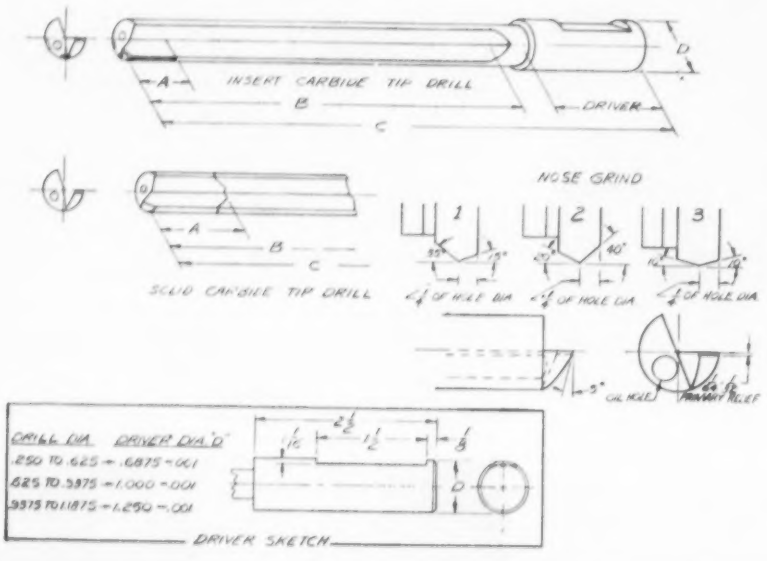


9 . . SMALL COMPONENTS, requiring shallow holes, are practical to gun drill because of the gain in accuracy and alignment; also because reaming and other sizing operations are eliminated. This machine is equipped to drill holes from 3/16 to 1 in. dia and from ½ to 10 in. deep. Spindle is driven by an adjustable speed hydraulic motor having a range of 400 to 3500 rpm. Workholding fixtures are designed around an angle plate which has a master liner bushing mounted in alignment with the machine table and the spindle. Four hold-down bolts permit sliding the angle plate to any desired position on the table, depending upon the desired depth of hole

10 . . HOW TO ALIGN THE GUN-DRILL SETUP—Gun drill, spindle, fixture (with bushing), and work *must* be perfectly aligned. The drill will go where it is aimed. To assure accurate alignment: 1) Obtain an accurately dimensioned test bar which fits the spindle adapter with a "plug gage feel" slip. 2) Mount indicator No. 1 on the test bar as shown. Zero-in the spindle and fixture bushing. 3) Remove indicator No. 1 and mount indicator No. 2 on the machine table. Zero-in the test bar by traversing the table (using slow feed). 4) Mount indicators No. 3 and 4 on the machine bridge. Place the indicator contact point on the spindle housing as shown and zero-in. 5) Mount indicator No. 1 on the test bar again; then check fixture bushing alignment with the spindle. When correcting alignment, use caution in adjusting the spindle. *The same readings must be maintained on indicators 2, 3, and 4.* This will maintain parallel alignment between spindle, fixture, and machine table. 6) Tighten all spindle and fixture hold-down bolts. Recheck spindle alignment. If drilling trouble occurs, check alignment first—then check further. Also, be sure drill is up to speed before it engages work



Gun drilling saved $280,000 + at Watervliet



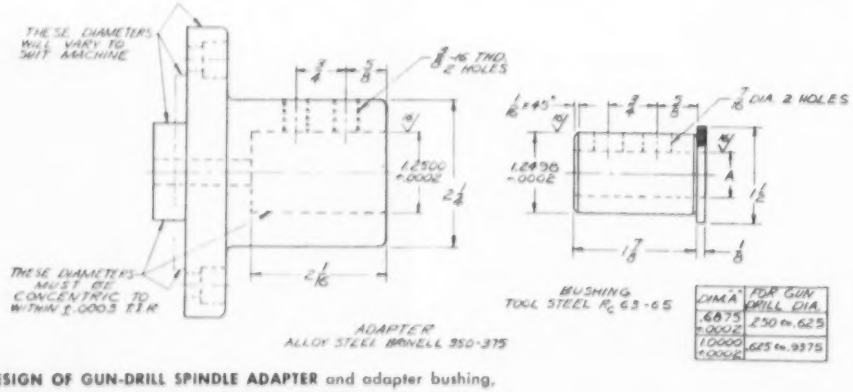
IN GRINDING CARBIDE GUN DRILLS, three different nose angles are most commonly used. No. 1 details correct angle for drilling high-physical alloy steel (275-350 Brinell). No. 2 and 3 show angles more suited to softer material (Courtesy Eldorado Tool & Mfg Corp)

A. Grinding the 35° and 5° (relief) angles

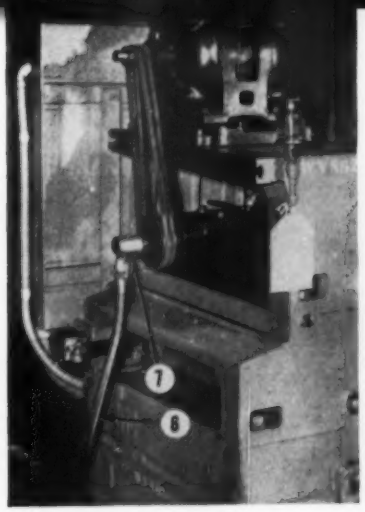
B. Grinding the 15° and 5° (relief) angles

C. Checking nose grind with a templet gage

12. . METHOD FOR REGRINDING and checking gun-drill nose angles, using a diamond wheel on a tool grinder



13. . DESIGN OF GUN-DRILL SPINDLE ADAPTER and adapter bushing, which are readily made with equipment available in most shops



15 . . COOLANT SYSTEMS

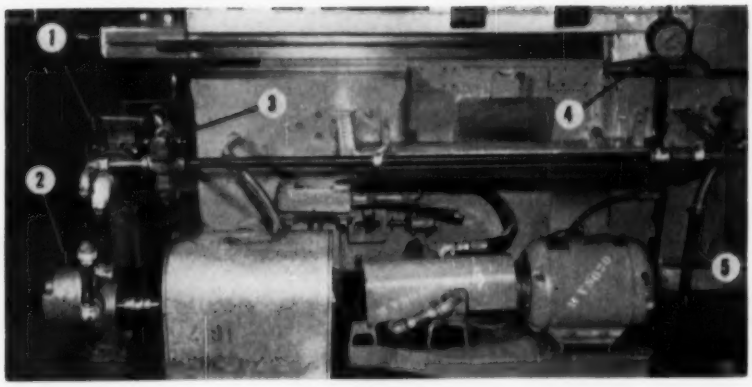
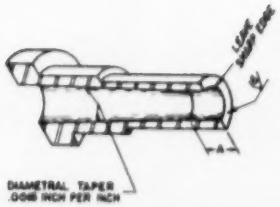


TABLE I—TYPICAL GUN-DRILL APPLICATIONS

EXAMPLE OF GUN DRILLING APPLICATIONS

COMPONENT	HOLE DIA.	HOLE DEP	RPM	SFPM	FIPR	CHIP LOAD	COOLANT PSI	BRINELL HARDNESS RANGE 275-350 CONVENTIONAL DRILL TIME FLOOR TO FLOOR	GUN DRILL TIME FLOOR TO FLOOR
20 M/M Bait Body D7231230	.654 .748	10-1/8" 5-1/2"	1000 1000	170 195	1." 1."	.0006 .0007	250-300	1 Hr. 36 Mins.	16 Mins.
20 M/M Spring Sleeve A7238869	.375 +.002	8" Blind	1500	150	1-1/2"	.001	250-300	1.26 Mins.	9 Mins
75 M/M Breech Ring D7237324	.750 +.003	16" Thru	680	140	5/8"	.0009	400-450	8 Hrs.	30 Mins.
75 M/M Breech Block D63278	.375 +.001	6-1/2" Thru	2000	180	1-1/4"	.0006	300-350	30 Mins.	20 Mins.
75 M/M Breech Block P7308308	1.000 +.002 .1875 +.005	3" Blind 1" Thru	570 3500	150 175	7-16" 1-3/4"	.001 .0009	500-600	7 Hr. 30 Mins.	1 Hr. 19 Mins.
90 M/M Breech Block D36327	.249 +.0005	8" Thru	3710	240	1-1/8"	.0003	300-350	1 Hr. 37 Mins.	31 Mins.
90 M/M Breech Ring D7305403	.750 +.005	15" Thru	950	185	15/16"	.001	400-450	1 Hr. 30 Mins.	30 Mins.
90 M/M Breech Ring P7238611	1.000 +.002	4-7/8" Thru	850	222	5/16"	.0003	275-300	2 Hrs. 40 Mins	40 Mins.
90 M/M Breech Ring P7238611	.375 +.002 Multi-Spindle	4-1/2" Thru	1900	183	1-1/4"	.0006	350-375	2 Hrs.	30 Mins.
90 M/M Breech Ring P7238611	.625 +.010 Multi-Spindle	9-1/4" Blind	1200	197	1-1/4"	.001	325-350	1 Hr. 30 Mins.	30 Mins.
105 M/M Breech Ring D7305232	1.000 +.010	11" Thru	750	180	7/16"	.0006	300-350	1 Hr.	36 Mins.
106 M/M Hinge Block D7307525	1.000 +.002	3-1/4" Thru	1380	380	1"	.0007	225-250	28 Mins.	12 Mins.
120 M/M Breech Ring D7305623	1) .500 +.002 2) 1.000 +.002	8" Blind 5-3/8" Thru	1527 750	195 195	3/4" 3/8"	.0004 .0005	300-325 Three-way Machine	16 Hrs.	4 Hrs. 36 Mins.
120 M/M Breech Block	.750 +.002	6-1/2" Blind	950	185	15/16"	.001	350-400	2 Hrs. 30 Mins.	30 Mins.



14 . . GUN-DRILL GUIDE BUSHING used in fixture to start drill in work

TABLE II—TROUBLE SHOOTING

IRREGULAR CONDITIONS	POSSIBLE CAUSES
Long stringy chips	Too light a feed Drill nose angles improperly ground.
Discolored chips	Feed too heavy R P M too fast Coolant supply inadequate
Drill breaking during drilling cycle.	Coolant pressure too low. Feed too fast. Space between workpiece and drill bushing Dull drill. Table stops not properly adjusted.
Bell mouthed hole	Guide bushing oversize.
Hole diameter oversized	Drill nose angles improperly ground. Slow feed.
INDICATIONS	POSSIBLE CAUSES
Workpiece hole location inaccurate.	Improper alignment of spindle, guide bushing and drilling fixture.

coolant and chips are ejected in large quantities and sometimes with considerable force or "throw." Depending upon the drilling operation, guards may be all plastic or metal with an observation window. Fig 3 shows a metal guard with Lucite windows.

AUTOMATIC DRILLING

Electrical circuits vary with the drilling application. The circuit must operate in conjunction with the hydraulic table-feed cycle. For example, one machine is wired so the right-hand spindle will drill a hole 0.1875 ± 0.005 in. dia by 1.00 in. deep and the left-hand spindle will drill a hole 1.000 + 0.002 in. dia by 3 1/64 in. deep. Here is the cycle of operations:

1) Work is positioned in the fixture and clamped. If a screw bushing is used, fasten it against the work; otherwise secure the work against the bushing. 2) Turn on hydraulic and coolant pumps. 3) Engage table-operating lever. 4) table moves left in "rapid traverse" until drill reaches position about ⅛ in. from work, then reverts to "slow feed." At this point, left spindle begins to function. 5) Table continues travel to left. At end of stroke, table dwells and an electric timer cuts into circuit permitting spindle to rotate a few seconds to clear all chips. 6) Directional flow of coolant, which is controlled by a solenoid, is now directed from the left- to the right-hand spindle. 7) Procedure described in (4) and (5) is repeated, except that table travels to the right. At end of stroke limit switch stops spindle and table returns to center.

If coolant pressure or quantity fall below that required, a pressure switch in the feed line, in series with a float switch in the reservoir, stops the machine. An emergency stop button is also provided.

CURVED CASTING and 1020 steel ring segments form a jet fighter tail skid assembly. Special casting has high impact and abrasion resistance to resist shock and wear without damaging aircraft-carrier decks. Contour tolerances are close and a sound joint is essential to meet operating needs

Curved surfaces brazed without distortion

Brazing curved wear-resistant castings and curved steel plates to form aircraft tail skids requires sound joints and close control over contour tolerances. Here's how the job is done—holding contour radii within ± 0.001 in.

To suit conditions on aircraft-carrier landing decks, McDonnell *Demon* Navy jet fighters are equipped with special curved tail skids. Castings employed for contact surfaces are an iron-base alloy containing chromium, molybdenum, manganese, and silicon. Known as "Wallex", the material is produced by the Wall Colmonoy Corp, Detroit, is abrasion and impact resistant and has a low coefficient of friction.

Contour radius of the curved tail skid must be held within ± 0.001 in.—presenting a tricky problem in joining the castings to curved steel mounting plates. Previously, the castings were joined to individual curved steel plates, but thermal stresses raised during brazing caused serious warpage and distortion. This not only made it necessary to anneal and add forming operations to hold tolerances, but it also produced voids in the joint and resulted in unacceptable assemblies.

Wall Colmonoy then devised a method of brazing components without distortion and without special machining and forming operations. Solution was to braze three castings to a ring, and later separate the unit into three tail skids. The inside radius of each casting is ground to conform to the outside radius of a 1020 steel ring—made from tubing with a ¼-in. wall and cut into 2¾-in. lengths. OD of the ring is ground to 5.750 in. ± 0.001 in. Thermal stresses developed in the ring during brazing do not affect dimensional tolerances because of the rigidity and restrained nature of the cylindrical shape. All critical machining operations are performed before brazing; only light facing operations are required afterwards.

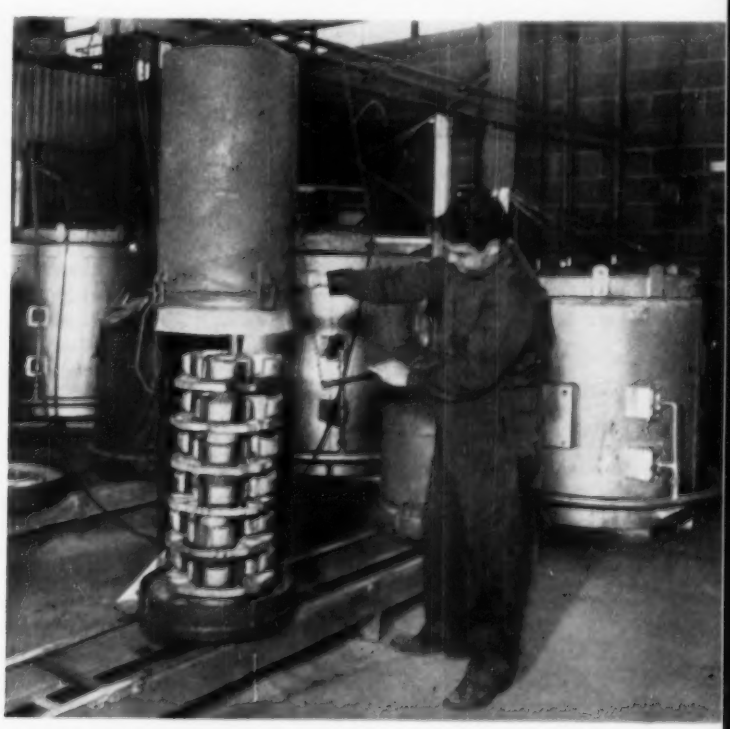
A simple drill jig is employed for drilling three ½-in.-dia holes 120° apart around the periphery of each ring. First step in joining is to spot weld the castings in place—centered over each hole. Copper brazing alloy is then applied around the castings and inside the three holes on the ID of the ring. During heating, the brazing alloy is drawn up through these holes and is evenly distributed under the castings. This insures good alloy flow between the casting and the ring and produces an excellent bond.

A stop-off liquid is applied to confine flow to the joint area—eliminating waste of the brazing alloy and improving appearance of the finished tail skid. Assemblies are then loaded into a retort containing a dry hydrogen atmosphere and the retort placed in a brazing furnace. The protective atmosphere prevents scaling and insures a good joint. After brazing, each ring is cut to form three tail skids without the need for additional finishing except facing the ends.

THREE EQUALLY SPACED HOLES are drilled in steel rings to act as capillary feeders for the brazing alloy. Drill jig also has three slots for scribing location lines on the rings to facilitate positioning of castings

TACK WELDING castings to a ring insures accurate alignment for brazing. Three castings are positioned and clamped in place for heliarc welding according to previously scribed lines. Each casting is centered over a ½-in. drilled hole in the ring

CONTROLLED FLOW of brazing alloy is achieved by applying a stop-off liquid to the tack-welded assembly. Because copper will not flow beyond the striped limits, it is confined to the joint area, and grinding to remove excess copper is eliminated



FURNACE BRAZING employs dry-hydrogen-atmosphere retorts for joining ring and casting assemblies. Each retort holds 18 assemblies which are later cut into three tail skids each—thus producing 54 parts in each brazing operation. Total brazing time, including setup, heating, and cooling, takes from six to eight hours

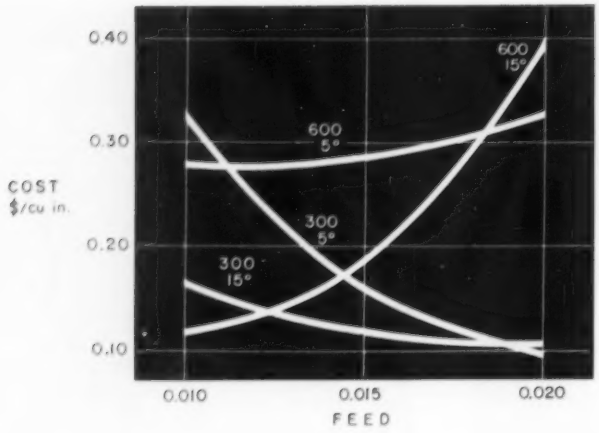


FIG. 1 . . Lowest cost per cubic inch can be achieved either by high speed with high relief angle and low feed, or low speed with high feed. Statistical tests produce charts like this quickly. The "300" and "600" are sfpm

Statistical methods bring economy to . . .

Shop machinability testing

R D HALVERSTADT
Metal Working Laboratory, Jet Engine Dept, Aircraft Gas Turbine Division
GENERAL ELECTRIC COMPANY, EVENDALE, OHIO

Confusing is the word for many machinability tests. The cutting process is so complex that it often does not give repeatable results; thus too much has often been assumed from too little—in laboratories as well as shops. Tests can disprove many of these old-wives' tales, but they are expensive. Statistics can save time and money. The author explains how

When the Metal Working Laboratory was started at Evendale, Ohio, the list of problems was endless and the surface could not be scratched unless some simplified method of testing was adopted. It was evident that an improved system could save both valuable time and material. The Statistical Sub-Section of the General Engineering Laboratory (Schenectady) has for a long time been engaged in designing planned tests for complicated research projects. The machinability test program was a natural for statistics, so several tests based on such methods were initiated. J A Zoellner, project engineer, Statistical Section, cooperated in these tests with the author, and was helpful in design and analysis.

Several different test designs have lent themselves to the needs of machinability tests. In general, the "searching" type of test has proved to be most advantageous. For instance, one design known as "½ of a 2^5 factorial design" can explore two levels of five different variables for only 16 tests. Thus, a fairly complete insight into the machinability of some new material can be had for minimum cost. The five variables could all be tool geometry such as rake, relief, and others, or could, as well as geometry, include speed, feed, and depth of cut. As the complexity of the test program increases, the advantages of a statistical approach increase.

In the event that it is desired to test two levels of seven variables, the statistical design requires only 32 tests out of a possible 128. If a more complete survey such as five levels of four main factors is required, a "box"* design can be applied. Such a test has a possible 625 test points, but the 4-factor, 5-level box design requires only 25 tests. Other data points can all be generated by the calculations of

*"Box" is a coined word standing for a class of experimental designs called central composite designs, first used to any extent by GEP Box, Imperial Chemical Company

the statistician, thus saving tests.

Many other tests are applicable to a particular situation. Exact design would depend on what sort of information is desired, ability of the operator to measure the variables, and many other factors. The important thing to remember is that each selection is based on the facts for that application. Thus, a machinability research engineer working with a good statistical man can select the proper test design. It is to be stressed that this is a branch of statistics separate from quality control, and the two concepts are somewhat different.

Some advantages of the statistical approach are immediately evident. Fewer tests mean lower costs in both labor and material, and this alone is a significant saving. However, some of the important gains come in the straight-forward manner of analysis of test data. The effect of a single variable can be separated and its effect on any one or more other variables can usually be determined. One important advantage is the measurement of test "error," which has been a nemesis of machinability testers for years. Space does not permit additional enumeration, but the statistical approach has saved a great deal of time and money.

The methods of evaluation that can be used on a statistical test can be the same as on other types of tests. Thus, "wear land," or cubic inches of stock removed per tool grind, is perfectly applicable. Most of the testing by the author was done by measuring flank wear land as a function of cutting time. Data can then be evaluated in terms of finish or other desired criteria.

RESULTS

Measurement of test error—The test error for any one single test, as measured in most of the investigations, varied from about 75% to 25% of total tool life in minutes. However, because the tests can predict an over-all estimate based on several readings, the final error of estimate varied between 5% and 15% of total tool life in minutes. For example, in one particular test, tool life varied from 6 to 16 min. for a specific tool wear, with an error for any one test of around 4.5 min. However, the statistical analysis predicted results sufficiently accurately so over-all test error was reduced to about 1 min. Thus, test results were accepted with considerable confidence.

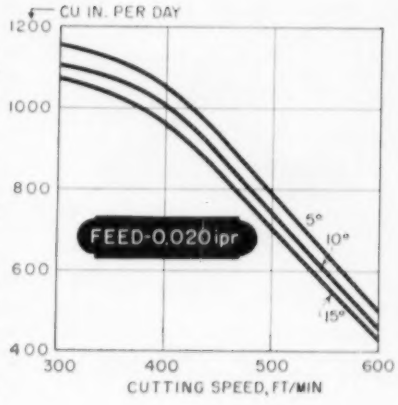
Speed, feed, depth of cut, and tool geometry—Various statistical tests have shown that there is certainly no "magic" connected with any of the three factors: speed, feed, and depth of cut. Tests have always indicated that there is usually a definite reason for any of the relationships which involve the three main factors. Each will be discussed individually.

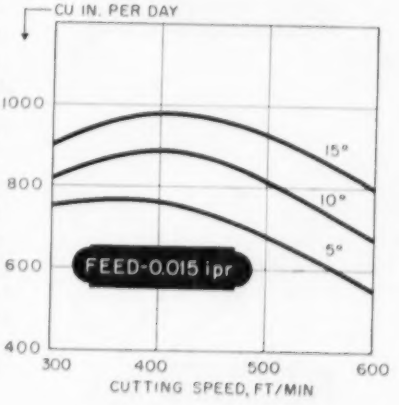
Speed—Cutting speed still remains as just about the most important facet of any machining operation. With most HSS tools, the actual available range is usually limited because a speed which is too high will result in rapid failure, while an extremely slow speed is usually not economically feasible. Carbide cutting tools exhibit a marked tendency to chipping and early tool failure if speed is too low; if speed is too high, tool life will be reduced. Thus, with both types of tools, the speed range is somewhat limited. Recent developments have shown that speed selection is largely economic and is based on:

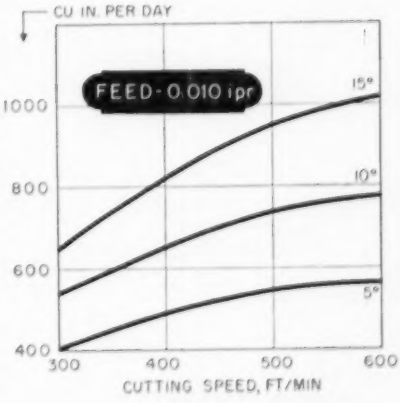
a. How much can be accomplished per day?

b. What is the minimum cost per manufactured part?

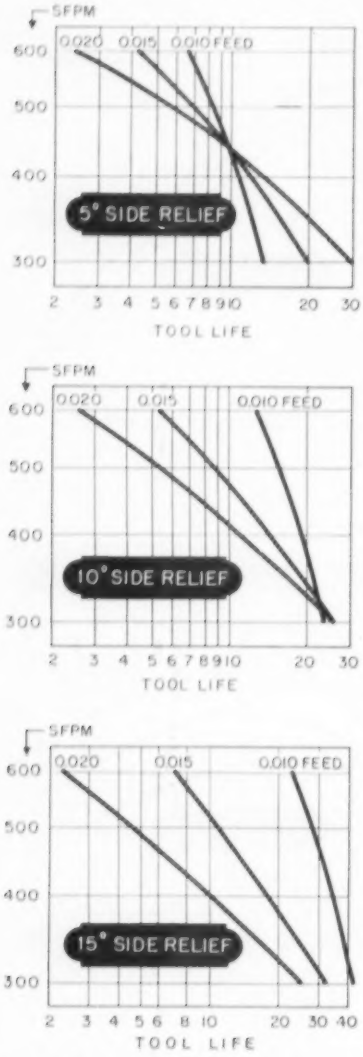
Therefore, after considering all related factors, the effect of speed can be shown by using charts such as Fig. 1, 2, 3, or 4. Thus, it is possible to achieve minimum cost with more than one condition, Fig. 1. For instance, a high speed might be combined with a high relief angle and a low feed to attain the minimum; the same result might be achieved by running at a much lower speed but with a high feed. The exact condition to choose can be based on your conditions and equipment. Thus, if you had a light part, a light feed and high speed would be desirable. The opposite would be true on a heavy part with an antiquated machine tool. Therefore, the only way to study this exact condition is to know all about







FIGS. 2, 3, 4 . . Stock removed per day varies with cutting speed and side relief angle. Here are three charts for comparison, with three rates of feed. Again, statistical tests make such charts economical



FIGS. 5, 6, 7 . . Relationship of speed, feed and relief angle all affect tool life, but feed less than the others

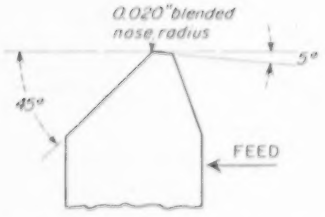


FIG. 8 . . Geometry for a typical tool to machine high-temperature alloy M-252. Practically no change in tool life occurred when depth of cut was changed from 0.060 to 0.250 in.

how the various factors affect the material you are cutting. With this knowledge you can choose the most economical operating condition which will satisfy your production requirements. About the only way to obtain these data economically is through the use of statistical tests.

Feed Rate — Machinists have known for years that it is usually more economical to increase feed rate than speed. The statistical tests have merely vindicated the fact that feed-increase is a powerful tool for higher production. This stems from the fact that tool life in minutes is not decreased proportionally to increase in feed—in fact, in some instances there will be little difference in tool life. A typical result is shown in Figs. 5, 6, and 7. This information may be somewhat surprising because it shows how speed, feed, and relief angle are related. It is apparent that there is a crossover point of speed where the relationships change.

Depth of cut—Tests have shown that there is no apparent major effect from depth of cut if the rigidity and heat-transfer capacity of the tool setup are sufficient. Tests have been conducted over a range from 0.015-in. depth to ¼ in.; however, heavy cuts are usually limited because:

a. In a machinability test, the cost of material limits the depth of cut.

b. In aircraft-engine machining, there are few places where extremely heavy cuts can be taken.

In general, it has been found that if the portion of the cut depth which includes the nose radius is small in proportion to the whole depth, there will be little difference in various depths of cut. However, where the nose radius is a large part of the total depth, the effect will be appreciable. For instance, in tests of 0.060-, 0.080-, and 0.100-in. depth, with 0.040-in. nose radius, there was only a small reduction in tool life. In another instance, high-temperature alloy M-252 was being machined with a typical high-temperature tool geometry. There was practically no change in tool life when depth was changed from 0.060 to 0.250 in. (see sketch, Fig. 8).

All portions of the cut were taken with essentially the same geometry. Factors that could make the difference are heat transfer and rigidity. Thus, as the setup was solid, no important vibratory fluctuations were added to the cutting process. Heat transfer was not a limiting factor because additional edge gave extra conductive area which was more than adequately cooled by the shank of the tool and the coolant which was applied. If no coolant could have been used; the result might have been quite different. With a less-desirable geometry, tool life will probably improve as depth of cut is decreased because there will be a reduction in "chip-interference" and attendant heat generation.

("Chip Interference" is a term applied to the two different sections of the same chip. The part of the chip which is cut by the straight edge of the tool travels in a single direction normal to the cutting edge. The part cutting the radius is also normal to the cutting edge of the radius. Thus, the chip is traveling in many different directions, and the result is "balling" and "interference.")

TOOL GEOMETRY

Tool geometry has been found to be so important that in many jobs it has been the difference between success and failure. Some of the factors have been explored completely on one or two materials, but tests have not yet explored all geometry factors on all materials. It will be well to again look at each factor individually:

Relief Angles—Both side and end refief have been investigated extensively on SAE 4340 in the annealed condition and in the heat-treated condition of tempered martensite at 30-32 R_c. In addition, tests have been made on various high-temperature alloys including A-286 and M-252.

Results have shown that relief angle is much more important than is generally believed. A glance at Figs. 9, 10, and 11 will show typical data where three different relief angles were used. It is apparent that relief angles do have a large effect on how long the tool will wear and that:

a. High relief angles materially increase tool life at the lower feeds.

b. Low relief angles tend to increase tool life at the higher feeds.

Inspection of Figs. 5, 6, and 7 show that there is a close relationship between relief angle, speed, and feed. Fig. 5 shows a surprising effect wherein at the lower operating speeds and low relief angle of 5° an increase in feed shows an increase in tool life. This same trend is noticeable on Figs. 6 and 7, but it occurs at much lower speeds as the relief angle is increased.

Side Rake—Most of the tests have used the term *side rake* to indicate the rake normal to the cutting edge of the tool. Side rake has been found to be important in that it will lower forces and appears to be instrumental in reducing the tendency to work hardening. The statistical studies have shown that side rake cannot be changed without affecting some of the other geometry factors. Generalized conclusions are:

a. High side rake tends to increase tool life when used with low relief angles.

b. Low positive or negative side rakes cannot be used with high relief angles because the forces are too high for the edge strength of a high-relief-angle tool.

c. That optimum tool life and cutting conditions are usually obtained by increasing side rake and side relief concurrently until a balance is obtained with the particular feed.

d. That negative-rake tools are usually suitable for use only with relatively high operating speeds.

Side and End Cutting-Edge Angle—Sometimes closely related, especially if relatively sharp-nosed tools are employed. In the later instance, the end cutting-edge angle helps to determine the strength and heat-transfer area of the tool point and has a profound effect on finish of the surface.

The side cutting-edge angle is perhaps one of the most important geometry characteristics. It is more important on the work-hardenable alloys than on the ordinary materials, but it has an appreciable effect on almost any material. Tests have shown that:

a. On some materials an increase in side cutting-edge angle from 15° to 45° caused an increase in tool life of 100%, Fig. 12.

b. The high side cutting-edge angle will lower the forces and will assist in decreasing the amount of work hardening.

Nose Radius—Capable of producing effects similar to side cutting-edge angle. However, nose radius is also related to total depth of cut, as mentioned earlier. In general, a larger nose radius tends to increase tool life.

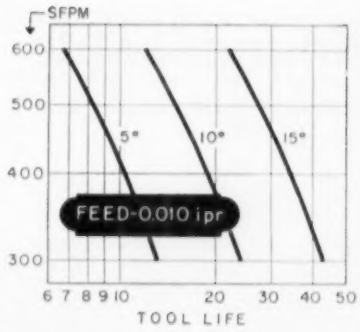
PRODUCTION APPLICATIONS

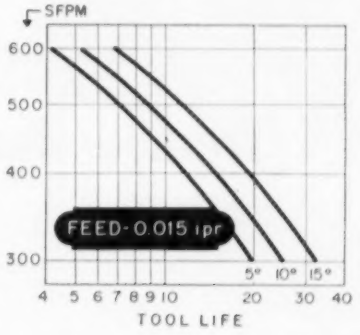
The chief value in the statistical test system is that the whole field of machinability can be explored for purposes of a comprehensive cost analysis. One such analysis has already been mentioned, (Fig. 1).

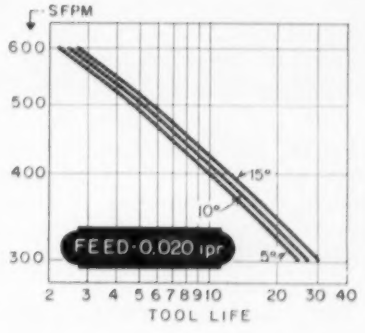
In some instances, an analysis based on the number of parts per day is equally important. The results of such a study are shown in Figs. 2, 3, and 4. The figures were constructed using average cost figures for downtime, tool-changing cost, and cutting time. Such curves will always have a maximum production point. At an extremely slow speed, tool life will usualy be large but production will be low because relatively few pieces will be made per day. At an extremely high speed, all the time will be spent changing tools as a result of decreased tool life. Thus, the optimum production operating point will be somewhere between the two extremes.

It can be seen that the greatest production is achieved at the 0.020-in. feed at around 300 sfpm. For the low feed of 0.010-in., production is maximized at around 600 sfpm. At 0.15-in. feed, the maximum is achieved at 400 sfpm, as would be expected.

Production and cost analysis is the important result of almost any machinability study. The only way by which this study can be accurately carried out is by a thorough knowledge of the facts covering the particular material being machined. The most economical method of obtaining the facts is by the statistical method of machinability testing.







FIGS. 9, 10, 11 . . Relief angle is important, witness the differences as it is changed

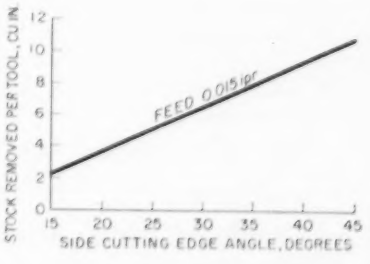


FIG. 12 . . Turning-test results at 75 sfpm on high-temperature moly-nickel alloy. Tool life was doubled by increasing side cutting-edge angle from 15 to 45°

Round Table

Trouble Board

"It sure takes a lot of hand-holding to run a production department, Ed. I'd swear some of my men weren't out of high school, if I didn't know better."

"What's the trouble now, Al? Somebody lose something and want you to find it?"

"Well, after a fashion. You know we let the men put up personal notices about things they want to buy and sell on the department bulletin boards. Well, somebody in another department advertised a car for sale, and Hanks bit. Then he found out it was a real lemon, and he's been on my neck ever since."

"So what? Tell him to chase himself, Al. It isn't your responsibility."

"Sure; I know it isn't, and you know it isn't; but Hanks thinks the company should look out for his interests—just as if he didn't have a brain in his head."

"Look, Al; you've got to tell him off—and be rough about it. I know the type. There's always some knucklehead in the department who gets stuck and wants the foreman to bail him out. Forget it. The company is no more responsible for those used-car and appliance ads than the man in the moon."

"Sure; but when I get good and sick of letting him bother me, what do I do—fire him? That's the only way to stop him, I guess. He's been needling me for a couple of days now. If it isn't an interview he wants with Harrison, it's advice about a lawsuit. Have I got a legitimate case of idiocy, or do I have to baby him along?"

"Well, you can't fire him, just for that, Al. Just tell him to knock it off. Threaten him if you have to; but I don't think you'd better go that far. I doubt if the Personnel Department would stand for it."

"Maybe that's an idea, Ed. I can send him to Personnel. I've always wanted to get back at them for hiring Hanks in the first place."

"Why don't you squelch him yourself, Al? It's good practice. You're bound to get a crybaby once in a while."

"Yeah, and it's always the ones who are the stupidest about what they do that cry the loudest when they get stung—which is just what Hanks was asking for."

"Step on him, Al. That's the only way you can shut him up."

"I can think of a better way—out the door on the end of my toe."

***SHOULD AL ALLOW HIMSELF** to get irritated by the guy who gets stung, and then expects the company to make it up to him? Should he be allowed to fire the man if he bothers him excessively? Is Ed's advice better? Your ideas on the subject may help others with the problem. Discussion of earlier topics start on page 208.*

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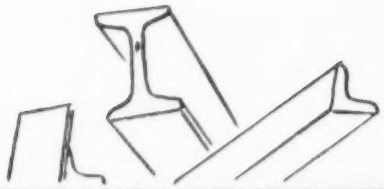
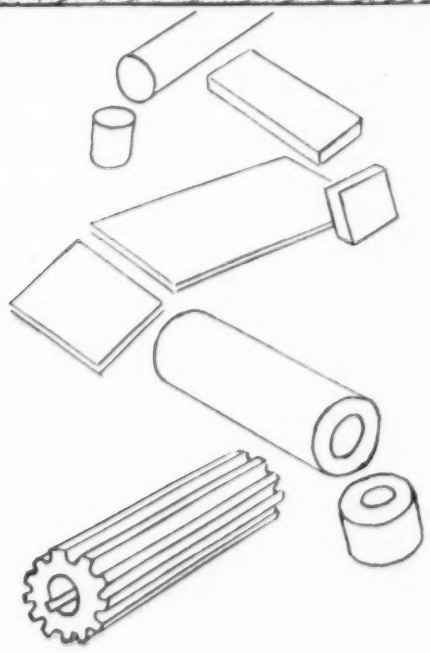


• SINGLE-POINT TOOL • SHEAR • FRICTION

• BANDSAW • ABRASIVE WHEEL • HACKSAW

• CIRCULAR SAW • RECENT DEVELOPMENTS

How to Cut Off Metals



CHARLES EMERSON, associate editor

One handbook puts it this way: Cutoff is so common, nobody pays much attention to it. But because it is common, it costs plenty, in total. There's almost no stock that can be started through a machining or forming schedule without being cut off, first, in some way. Bar, angle, flat, strip, sheet, tube, billet, wire, and even cast stock must be cut to elementary shape to start with.

There's not much new in cutoff, either. Perhaps a new process or two; maybe a good number of new applications; but the fundamentals are still basically the same as they have been for many years. But many processes can be adapted, changed, simplified, or modified for better cutoff faster. Here, then, are the fundamentals, and some ideas as to how savings on a universal and much-repeated operation can improve efficiency and profit.

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Single-Point Cutoff

As the lathes are the primary machine tools, single-point cutoff on lathe-type machines is also one of the basic cutoff methods.

Traditionally, lathe cutoff tools are thin, flat, and take a necking cut. When the cut starts on the OD, cutting can be just as efficient as the best turning done—high speed, good feed rate, good chip characteristics, and favorable results. But when the tool tip approaches the center of the work, things get less favorable.

First is the loss of surface speed—speed of work relative to tool tip. If good cutting characteristics depend on a high surface speed—as they usually do with carbides particularly—the tool is likely to be affected by forces and pressures beyond its design limit. If for any reason the tool has a tendency to jam in a tight neck (because of its design, or because of overheating of tool or work), it will happen then. If the tool has a tendency to flex, wander, cut under or over center, or do anything unexpected at all, it will happen as it approaches work center.

One answer is a variable-speed drive, which will increase rotary work speed as the tool penetrates, which keeps surface speed up. There's a limit, of course, and if the tool must cut to center, there still may be a point at which everything goes wrong.

CURES FOR CUTOFF PROBLEMS

If general rules can help prevent cutoff troubles, or eliminate them before they start, a page from good turning and facing practice will do the job.

1 . . Support must be firm; as solid as possible. In some cases where spring-loaded, notched, or goose-necked tools are applied, the only spring should be where intended. The tool must be solid in the holder, and the holder base or shank must be firmly mounted on the carriage. Solid mounting is even more important, if possible, for carbides.

2 . . Overhang must be at a minimum. Even a strong, wide tool deflects slightly; but the less deflection the better. Any time the tool moves it will tend to butcher up the chip flow, which will cycle chip load on the tool. If the tool twists, it will instantly change cutting angles, endangering the work and the tool itself.

3 . . Tool shape must be strong. Front relief should be as little as necessary, to prevent rubbing and friction-heat buildup. Support for the tool tip is all-important. Side relief is important; but excessive side relief may easily result in broken tool edges. Top rake helps cutting action, but too much builds up heat and makes it more difficult to get coolant where it is intended to get.

Beyond these three points, there are many variables, depending on circumstances.

One interesting point: A parting chip is wider than the tool, the effect of side burr on the chip. It can jam in the slot, rub and raise the heat level, scratch the sides of the neck and ruin the finish, and generally play havoc with the work and with the top of the tool-bit. Some tool grinds tend to minimize this effect; a concave top grind or shallow V, for example. Both tend to force the chip to compress on itself, and usually produce better finishes on the faced-off work ends. But this extra action inside the chip results in more heat, and the more rakish side edges of the tool are more subject to heat damage and breakdown from simple pressure. Sometimes such tool grinds help, but if carried to an extreme they result in worse cutting.

WHAT THE ANGLES DO

The end cutting-edge angle, commonly called the lead angle on cutoff tools, is ground in to simplify parting without leaving a tit on the work. Actually, a lead angle is the reverse of an end cutting-edge angle; it normally arrows to the right (on an ordinary lathe tool), with the apex of the angle toward the part being separated from chucked stock. Theoretically, the pointed tip of the tool will come to work center first, the work will drop off clean, and stock still in the lathe will have a small cone on its end, on center. If setup work is handled carefully, which it should be for a long screw-machine or similar run, cutoff can be as clean as if the work were faced off with hand controls. Most likely a small tit will be left; in many cases it doesn't matter; in others it can be easily removed in a later operation or with a file.

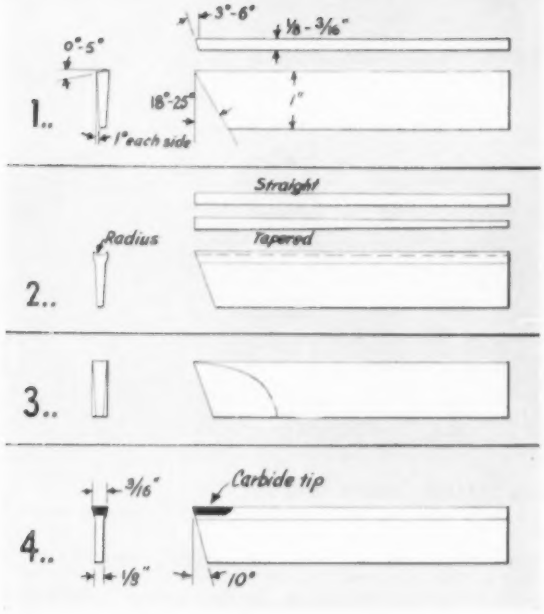
The trouble with a lead angle is that a slanted front edge of the tool is expected to feed straight into the work; actually the slant has a marked tendency to force the tool toward the apex of the lead angle, producing a concave end on the work cut off, and a convex end on the stock left. If the tool is firmly mounted, the effect will be slight; but on precision work it may be detrimental. If the tool is not firmly mounted, and can swing to the side, the lead angle will surely force it over.

Often enough a small lead angle—as little as 3-4°—will do the job of making the work part where you want it to. Leads as large as 15° are sometimes applied; they work in many cases. But the tool tip has less physical support and there is less metal close by to help conduct heat away. A large lead angle undoubtedly contributes to shorter tool life, though proving it with facts and figures might be difficult.

A straight-edge tool, with no lead angle, cuts better; straighter and more cleanly. But as it approaches work center, the small neck left on the stock starts to give away; the work beyond the tool tends to start wobbling, which makes the neck give more—especially at the corner nearest to the headstock. Finally, the work will break off, taking a good-size tit with it, though often leaving the stock still chucked with a clean face.

CLEAN CUTOFF OVERRATED

How much is a good clean cutoff worth? It ties the whole job neatly up into a package; but just because cutoff is clean doesn't necessarily mean the job has been done most economically. How much could be saved in less fussy and tedious setup—making sure the tool height is right, the grinds are OK, and alignment is perfect? How much time could be saved by cutting faster (because a fairly slow approach to center is necessary for a really clean cutoff), even though sloppier? It depends on circumstances; but there are many cases where perfect cutoff is a waste of time and money.



TYPICAL SINGLE-POINT CUTOFF TOOLS . . .

for automatic and semi-automatic operations. (1) is a commercially available bit with side clearance and front lead angle intended to eliminate tit. (2) is another commercial blade with concave top that produces side rake. Tapered blade has built-in side clearance; wearing and regrinding reduces width and strength, but not rapidly. (3) is straight, rectangular blade with side clearance ground in. (4) is for tubing

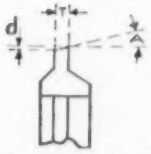


TABLE OF ANGLES AND THICKNESSES FOR CIRCULAR CUTTING-OFF TOOLS

Diameter of Stock	T Thickness	Depth of Angle A	
		for Brass	for Steel
1/16	.020	.0085	.0055
3/32	.030	.013	.008
1/8	.040	.017	.011
3/16	.050	.0215	.0135
1/4	.060	.0255	.016
5/16	.070	.030	.019
3/8	.080	.034	.021
7/16	.090	.038	.024
1/2 to 9/16	.100	.042	.027
5/8 to 3/4	.120	.051	.032
13/16 to 1	.140	.059	.038
1 1/16 to 1 5/16	.160	.068	.043
1 3/8 to 1 7/8	.190	.081	.051
2 to 2 1/2	.220	.093	.059

CIRCULAR TOOL FOR SCREW MACHINE . . .

has 23° lead angle for soft metals; 15° for steel, iron, bronze, and nickel. Least thickness for tubing cutoff is 2/3 recommendation for same OD of solid stock, as listed in table

Another point: If you follow common practice and set the tool just a bit above center, to compensate for tool deflection under chip load, the tool tip will end up at center still above center, because at center the chip load, hence deflection, is much less. If you can't hit center anyway, why worry about fussy setup?

WHY IS CUTOFF DIFFICULT?

The main trouble in cutoff is the fact that two pieces of metal are actually parted from each other—which sounds obvious, but really has a meaning.

It's the breakthrough—the instant when the tool comes through the last bit of stock and out into the open—when most of the trouble crops up. On tubing there isn't usually too much trouble, though a burr is often formed, and the bit may come through one side of the tube, whereupon the tube starts to flex. This may jam on the tool, causing breakage or at least dull the edges. But usually the lead angle is ground so the burr will form on the piece being cut off, leaving stock still chucked in clean condition. Another operation to remove the burr is often a foregone conclusion.

Solid stock is another matter. Unless there is a pick-off mechanism or some kind of outboard work support to keep it from moving (other than rotating), the piece will flex and cause some damage to the tool. Eventually, of course, the accumulation of minor damage will show up, which means a tool regrind.

This brings up the possibility that in some cases it may be sensible, and economical, to cut most of the way through with a standard tool; then rely on something else to complete the cut. Perhaps a second cutoff tool, identical to the first, might be brought in from the rear to pick up half the chip load. With the

MATERIAL →	Free cutting brass use maximum* spindle sp. available on machine	11-St. Aluminum 800 S.F.	17-St.* Aluminum 550 S.F. 53-St.* Aluminum	24-St. Aluminum* 400 S.F. Copper 300 S.F. naval brass 200 S.F. tobin bronze	High sulphur steel (B-1113) (X-1112) (B4512A) 225 S.F. (C-1113) 196 S.F. (B-1112) 165 S.F.	Type 416 stainless steel 130 S.F. steels	112 S.F. steels	95 S.F. steels	All other stainless steels tool steel 75 S.F.—Monel phosphor bronze—H.S. steel (60) (65) S.F.	← MATERIAL	Cut	Tool
	.0015	.0008	.0007	.0006	.0005	.0005	.0005	.0004	.0004			Cutoff Tools: Angular
	.0035	.0018	.0016	.0015	.0013	.0013	.0012	.0011	.001		.040 to ¼ W	Over ⅛ Stock / Circular
	.002	.001	.0009	.0008	.0007	.0007	.0006	.0006	.0005		.020 to .040 W	Under ⅛ Stock / Straight

S.F. = surface feet
W = Width of Cut

CONSERVATIVE SPEEDS AND FEEDS FOR HSS CUTOFF . . .

are for straight tools when stock is under ⅛ in. dia, and for circular tools when stock is over ⅛ in. dia. Feeds are in in./rev; numbers followed by SF indicate relative speed at which they can be machined (surface feet/min)

back force from the stock split two ways, action on the tool would be cut in half.

Another possibility is to bring in an entirely different kind of tool to finish cutoff; for example, a small, sharp, air-powered shear blade might be added to knock off the part being machined when the cutoff neck is down to 1/16 in. or so. Or an independently powered sawblade could be driven to do cutoff cleanly after the parting tool has established a smooth neck. About the only thing that might not be sensible as a possibility is a pair of tinsnips—and they might do a job in an odd case.

Lathe cutoff, by nature of the kind of machine and tools being applied, goes from good to terrible, as far as cutting speed and metal removal are concerned. At the "terrible" end of the cut, if fast production is of any importance, some other method of metal cutting may well save tool material, second operations, time, and effort.

TOOL MATERIALS

If cutoff isn't going right, changing blade angles isn't the only way to change results. In many cases, where the machine is automatic, it is less desirable to change the blade because the setup requires a certain specific shape. But blade material can be changed, and HSS isn't the only cutoff-tool material.

Alloy tool steels with high abrasion resistance, heat resistance, and other special properties can be formed into cutoff tools otherwise identical with the original tool, and may provide much better results. The most critical condition a cutoff tool can encounter is overheating. In one case, better coolant flow may solve the problem; in another, change tool material.

Often enough, the machine or toolholder requires a given shape of tool, frequently with no top rake other than that built into the holder. On tools that are intended to be reground simply by taking a cut across the front, side cutting-edge angles and rake can't be changed. The main solution to finding considerably different tool characteristics in such cases means getting another material.

Cast-alloy tool steels for cutoff work can also be picked for better toughness, if the cut is intermittent or the material is not homogeneous. These last two limitations are ones that make carbides less desirable. Actually, cast-alloy tool steels probably don't get as much play for cutoff work as they deserve.

CARBIDE FOR SPEED

The main advantage of carbide in a cutoff tool is it allows faster cutting rates. If a turret lathe or automatic is set up for carbide turning and facing operations, carbide cutoff naturally follows. It not only stands up under high surface speeds; it also works under conditions of heat (excepting thermal-shock conditions) and wear that would wilt HSS.

Yet, carbides are not widely used for cutoff; mainly because at slower surface speeds, as the tool approaches center, it is subject to conditions that may easily break off cutting edges or cause metal buildup on the tool.

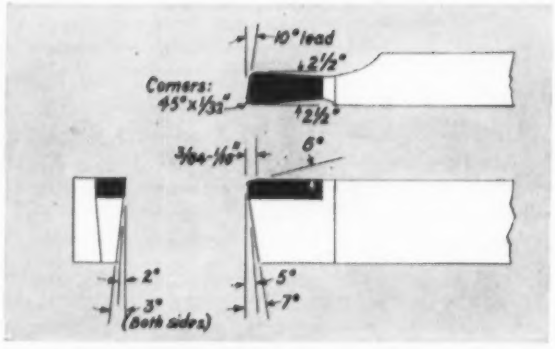
But some carbide cutoff is being done; the illustrated tool shapes have been applied successfully in some cases. Mainly, good cutting off with carbide depends on tool angles and stiffness of the setup.

The shapes used for HSS cutoff blades won't usually work well in carbide; a carbide-tipped HSS toolbit is not a fair test of what carbide will do, unless geometry is changed.

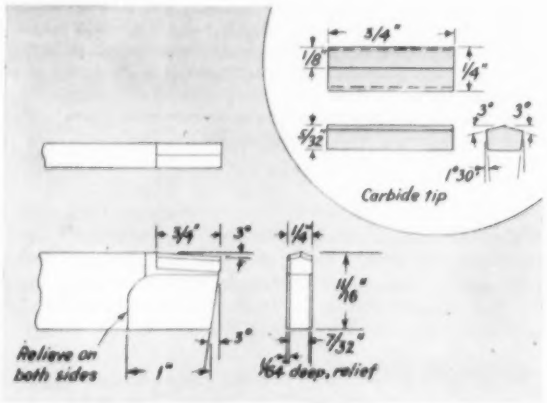
STANDARD CUTOFF-TOOL DIMENSIONS—ASA B5.21-1949
LATHE AND SCREW MACHINE

Width	Height & Length				
1/16	1/2x4 1/2*	11/16x5	13/16x6		
5/64	1/2x4 1/2				
3/32	1/2x4 1/2*	11/16x5	13/16x6	1x6 1/2	
1/8	1/2x4 1/2*	11/16x5*	13/16x6	1x6 1/2	
5/32		11/16x5*	13/16x6		
3/16		11/16x5*	13/16x6	7/8x6*	1x6 1/2	1 1/8x6 1/2*
1/4			13/16x6	7/8x6*	1x6 1/2	1 1/8x6 1/2*

*Preferred sizes for future design, though other shapes are not to be considered special. Width here is maximum width; cross-sectional shapes may not be rectangular, depending on manufacturer's design.



SHELL-CUTTING CARBIDE TOOL . . .
is set above center as much as 1/32 in. Tool has Carboloy grade 788 or 370 insert, brazed in place. Critical point is at breakthrough, when shell or tubing may partially separate, and remaining web will pinch carbide edges. One solution is to stop feed when tool has formed unbroken welt on inside wall of tubing; rely on sharp blow to part stock after it's removed from lathe



THIN CARBIDE-TIPPED PARTING TOOL . . .
for solid stock or Shelby tubing will cut to center. Steel shank is relieved slightly on each side, and carbide is hollow-ground on sides to blend. Top rake is negative, and negative rake has been applied to sides of bit. Same geometry has also been used on vertical-shank tools with success

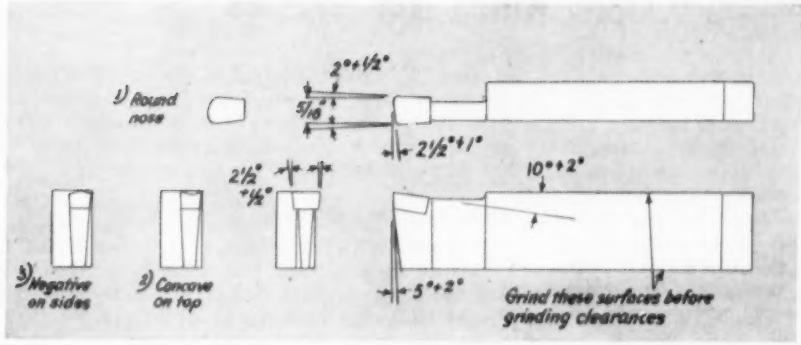
Yet, carbides are not widely used for cutoff; mainly because at slower surface speeds, as the tool approaches center, it is subject to conditions that may easily break off cutting edges or cause metal buildup on the tool.

But some carbide cutoff is being done; the illustrated tool shapes have been applied successfully in some cases. Mainly, good cutting off with carbide depends on tool angles and stiffness of the setup.

The shapes used for HSS cutoff blades won't usually work well in carbide; a carbide-tipped HSS toolbit is not a fair test of what carbide will do, unless geometry is changed.

SPEEDS, FEEDS

There seems to be general agreement that surface speeds should be as high as possible—450 sfpm and up; at least where the cutoff starts on the OD. Feeds should



STANDARD TURRET-LATHE CARBIDE . . . has positive rake, small relief all around. If it doesn't work right, special grinds may be tried, including rounded nose. Concave grind on top provides positive rake on tool sides for better finish; but this shape is most easily broken at edges. For tough steels, including stainless, negative-side-rake grind is much stronger

range around 0.006-0.008 ipr at the OD; but if the machine can be equipped to slow down the feed as the tool approaches center, it should be done. When nearing center, a carbide parting tool should only advance 0.002-0.003 ipr; the same applies when parting tubing, just before breakthrough. On a cam-operated machine, this isn't too difficult to arrange; or a variable-speed drive will do the trick. On non-adjustable machines, a compromise feed rate can be picked, depending on results.

If an extra tooling position is available on the machine, it may be possible to rig the carbide tool to do deep necking; then bring in a HSS tool to finish cutoff to center. This way utilizes the high-speed possibilities of carbide without running near the risk when the tool approaches center, where work speed is low.

ANGLES

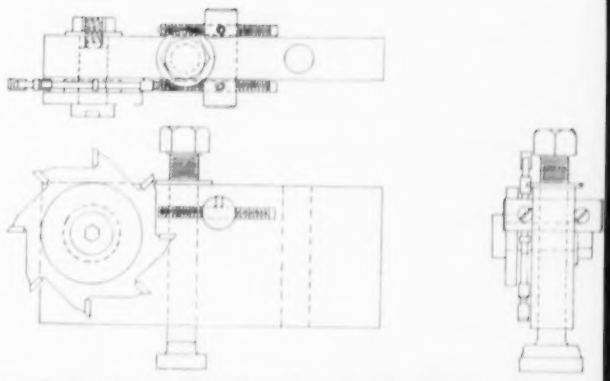
Carbides for cutoff are similar to turning tools, though most angles are somewhat smaller than are often used for simple turning. Clearances (relief) are low—ranging under 5°, and excessive negative top rake is not used. Actually, some carbide parting tools have positive rake, and have shown good results. It depends considerably on the chip load; high speed and light feed with plenty of tip support (low-angle end relief) may keep the tool cutting. But at full depth metal buildup on the tip may ruin a good job.

According to one manufacturer of carbides, experimental materials have been proven on cutoff work to full depth; they are not yet commercially available, but should be in the near future.

General recommendations, as above, are for steels. For low-carbon steel, one tool manufacturer recommends surface speed not over 300 sfpm, with feed under 0.005 ipr (for SAE 1010, 1117, etc).

Non-ferrous metals can be cut with no negative top rake, and with an increased lead angle. The limit on lead angle (usually 20°) is where the tool starts slewing toward the apex of the angle, which produces non-straight cuts. With less ductile materials, lead angle should be decreased. For magnesium and aluminum, lapped top face and relief surfaces are essential; in fact, lapping should improve any carbide cutoff work.

For large work, where the cutoff slot can be large, a brazed tool will usually work out. For a thinner cut, where wasting material is not desired, a solid insert may work better. In any case, the tool must be firmly supported. As one manufacturer puts it; carbides don't weave gracefully.



CARBIDE SAW MAKES RELIABLE PARTING TOOL . . . for screw machines; if one edge fails, another tooth is easily indexed into cutting position. If machine is tooled for carbide turning, cutoff can be uneconomically slow unless carbide is also used for parting. If carbide cutoff won't work perfectly, next best solution is quick bit changing, which this provides

One suggestion may be worth trying in the future; a bi-carbide tool could be built with a fairly thin top section (1/16 in. or less) made of a hard grade, and the tool body made of a tougher material (Carboloy 883 on top of grade 190, for example). The thin top veneer would accept some flexing without breaking, and the tougher body would absorb motion, too.

COOLANTS

There are two good ways to develop cracks in carbide tools because of thermal shock. One is to flood the tool while it's cutting; then let the coolant stop while another part is being chucked. When coolant comes on again, it quenches carbide and steel shank, which have by then spread residual heat around evenly. The other way is to heat the work and forget the tool. The tool gets a splash of coolant once in a while.

If cooling can't be applied evenly, consistently, and uniformly, it shouldn't be used. On some roughing jobs, for example, it's best to run dry. Heat in the chips lying on the apron can be handled by a spray of coolant directed there.

On light roughing, semifinishing, and finishing cuts, coolant can often be used to advantage. But it must be directed to the tool tip; often in multiple streams, sometimes with spray or mist.

Shearing—Four Rules for Blades

Good shearing depends on four factors: blade rake, clearance, sharpness, and machine adjustment. For normal straight shearing, the rake angle between upper and lower blades should be about on a pitch of ¼ to ½ in. per foot of blade length. This slight angle makes one corner of the blade start cutting first, and the cut progresses across the stock to the other side as the blade comes down to full depth.

Only one section of the metal is being cut at any given instant, so load on the machine is much less than if the whole width were chopped at once. A shearing blade has done practically all its work by the time the blade edge is roughly 50% through the stock. This figure varies from 40 to 70% for different materials, with the high figure for soft, ductile metals.

If stock is tougher or thicker than would normally be sheared on a given machine, the rake angle can be increased. This has the effect of shortening the cutting area even more, which reduces the load at any given time. But it also tends to twist the machine and put an uneven back load on its bearings, so extra rake should be utilized only when necessary.

SHEAR STRENGTH OF METALS

Material	Strength, Tons/sq in.
Aluminum	4.7—12
Aluminum (heat-treated)	16—19
Brass	16—22
Bronze	22—29
Copper	11—14
Inconel	32—42
Lead	0.9
Magnesium	9—10
Monel	25—32
K Monel	37—50
Nickel	26—39
Steel	20—30
Stainless	29

RELATIVE SHEAR STRENGTHS OF COMMON METALS . . . are primary guide to figuring power requirements for press cutoff. Note wide spread of values for some metals; properties depend on composition, heat-treatment, and manner of working

BLADE CLEARANCE AT END OF BLADES

Thickness of Material	Mild Steel	Stainless, Hard or Tough Steel, Copper, Brass, Aluminum
20 ga.	.003	.002
16 ga.	.004	.002
14 ga.	.005	.002
12 ga.	.007	.003
10 ga.	.009	.004
3/16	.011	.005
1/4	.013	.006
5/16	.016	.007
3/8	.019	.008
1/2	.022	.010
5/8	.026	.012
3/4	.030	.014
1	.035	.017

TYPICAL BLADE CLEARANCES FOR SHEARING . . . show considerable difference for mild steel and harder or more ductile materials

SLIGHT CLEARANCE ESSENTIAL

There must be some clearance between the two blades as the upper one passes the lower one; otherwise the stock would bind them and stall the machine. Proper clearance (see chart) depends on stock gage, and increases almost directly as stock thickness increases, up to a limit determined by blade strength and rigidity; or if the blade is short, by machine strength.

The natural tendency is for the upper blade to bow away from the lower one as the cut progresses along the metal. Therefore, large shearing machines have provision for adjusting counterbow. In this way the blade is supported in its center from behind—from the ram. If the blades came together without rake, they would strike in the middle because of this adjustment; but the natural bowing tendency is counteracted by this rear support to make the blade stay roughly straight throughout the cut.

Both clearance and this counterbow should be changed if stock gage is changed, but often repeated adjustments aren't practical in a jobbing shop. Usually clearance and bow are set for the thinnest stock being regularly sheared, and press power is relied upon to prevent damage to blades when thicker stock is sheared. Some materials, notably stainless steel, require very close blade setting and sharp blades, or the material will pull in between them, spoiling it and possibly breaking a shear blade.

Blade sharpness is an obvious factor. A well set blade can lose 25% of its cutting power when dull; beyond this point it may stop cutting altogether. A dull blade is its own worst enemy, and it tends to jam, bend, and distort the stock.

If the sheet stock is wider than the largest blade available, a double cut can be made. To prevent distortion of the stock, the first slice should be stopped with the high end of the blade still above the material; then the stock can be shifted over, the cut picked up and completed.

DIE SHEARING

Cutoff dies applied to press tools work about the same way, though they are usually small enough that bowing can be ignored. But blade sharpness, rake, and clearance are important.

Gaging and holding the stock are important factors in accuracy for any shearing operation. Holddowns strong enough to prevent the metal from creeping, but not so strong they distort the material, are essential. Accuracy in shearing to a given size depends on gage strength or solidity as well as on how closely the gages can be set.

If one edge being sheared should preferably be kept flat and straight, make it the edge that will lie on the fixed blade when shearing is completed. The moving blade that carries stock with it will have more tendency to warp the stock.

SHEARING CAPACITY OF TYPICAL SHEARS FOR VARIOUS MATERIALS

TYPE OF STEEL	APPROX. TENSILE STREN.	⅛-in. ¼° Rake Cap. Inch	¼-in. ⅜° Rake Cap. Inch	1-in ½° Rake Cap. Inch
1020 Steel	60,000	.250	.500	1.000
1030 Steel	65,000	.242	.480	.960
1045 Steel	70,000	.232	.463	.930
1095 Steel	100,000	.193	.383	.760
75 St Aluminum	58,000	.256	.510	1.020
¼ Hard Brass	48,000	.280	.557	1.130
¾ Hard Brass	58,000	.256	.510	1.020
Soft Copper	30,000	.355	.705	1.430
302 18-8 Stainless	90,000	.205	.406	.815
321 Stainless	100,000	.193	.383	.760
347 Stainless	100,000	.193	.383	.760
AMS-55-10 Stainless	85,000	.211	.419	.840
Timkin Alloy	110,000	.183	.364	.730
AMS-55-37 Haynes Stellite	125,000	.174	.346	.690
AMS-55-26 19-9 DX TIMKIN	100,000	.193	.383	.760
AMS-55-40 Inconel	90,000	.205	.406	.815
AMS-55-42 Inconel "X"	130,000	.169	.337	.675
Titanium Low Alloy	100,000	.193	.383	.760
Inland NAX	65,000	.241	.480	.960
Aircraft 4130	105,000	.188	.374	.750

SHEAR RATINGS ARE USUALLY QUOTED . . .

in thickness of mild steel, but capacities in other materials vary quite a bit. Note low figure for Inconel X, indicating extreme toughness. Capacity of any shear, known in mild steel, may be interpolated into capacity for other materials by proportioning with tabulated values above

WHY SHEAR AT ALL?

Shearing is commonly applied to large sheets of metal, and strip stock, because it is the only logical method of cutting off. Of course a gas torch can be applied, but it produces edges to less accuracy. The operation of shearing, itself, is fast enough; the main objection regarding time is setup and handling. For strip stock, an automatic press feed takes care of that objection and also speeds up piercing. Actually, cutoff is often eliminated with strip stock because the scrap skeleton can be rolled up and carted off to salvage while the blanked-out workpieces are produced in the dies.

On large sheet stock there isn't much choice if blanks have to be cut before forming operations can begin. The best cutoff (for any kind of stock) is no cutoff at all, but shearing sheets to size is often essential.

One help to production is to run as much stock of one gage and temper as possible at one time; then change the shear adjustments for another size and material to allow getting the most shearing out of the machine.

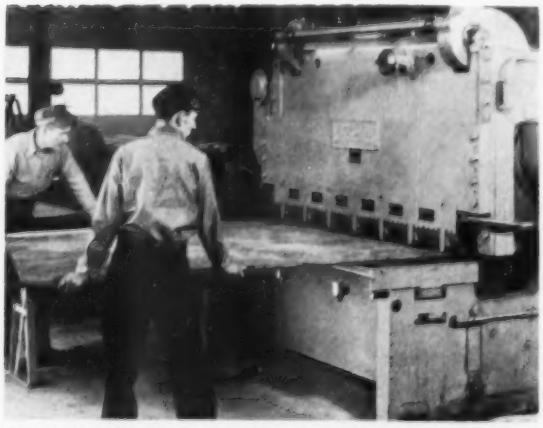
Nobody wants to invest in any more expensive machine than necessary, but one large shear can handle the same work two or more smaller machines might turn out. You can always shear small stock on a large machine; the main objection being a waste of power. And in a small or job shop, where different sizes, thicknesses, and shapes must be sheared each shift, a machine of extra-large capacity may mean the difference between doing all the jobs planned or having to drop some.

SHEARS CUT STRIP AND BAR

Most strip stock is intended specifically for continuous press operations anyway so adding a shear blade to a dieset is not a tough job, nor does it involve serious problems. About the same rules as applied to shearing larger pieces of sheet stock should be followed. If strip stock has to be cut in small lots, for jobbing work, it can be fed to a power shear.

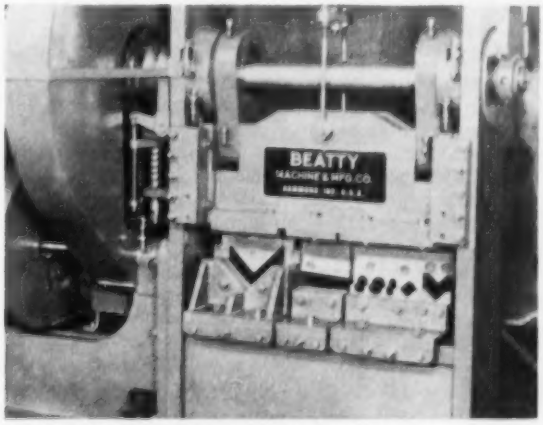
Often enough a stamping or piercing-and-blanking die set is arranged to cut out the desired metal contour, leaving a skeleton of strip stock that can be rolled up and converted into resalable scrap, so the cutoff problem is eliminated.

Bars are another matter entirely. There have been some cases, and there will be many more in the future, where a powered bar shear has been integrated with



STOCK HANDLING IS ALWAYS A PROBLEM . . .

at a power shear. Here a hoist could support the work. Best solution is to provide storage space for new and blanked stock, allowing full-time utilization of minimum number of shears and less-frequent setup changes (adjust gages, reset clearance, change blades, etc)



JOB-LOT MECHANICAL BAR SHEAR . . .

is set up for several sizes and shapes of solid bar stock with all tools at approximately the same level. This allows feeding any stock from a roller table, as might be done in warehouse. For faster cutting, as in a mill, power table can be set up in front to feed to one set of blades for the particular job

a press or forging line. Bar can be fed almost like strip, although it takes bulkier equipment.

It has to be sheared in one bite, and the advantage of rake on a shear blade can't be realized, unless you're dealing with fairly flat rectangular stock instead of round bars. If a press is rated at 100 tons, for example, it will cut through 2-in. rounds, 1¾-in. squares, or slabs 1x7 in., and that's about it.

Bar shears are available in two general types; guillotine—with blade support at both ends; and open-end machines. Open-end bar shears are usually fitted with straight blades, but can have V-notched or cut-out blades attached. Guillotine shears are often equipped with a set of blades of various shape; all on the same level to allow easy feeding, so the machine can be left set up for most cases. This means a machine with wider total blade length than you would normally require, but it eliminates much blade changing on a job shop.

TUBE CUTTING IS FASTER

Most tube shears work with a V-shaped blade that punches through the top tubing wall, shears down the sides, and punches out the bottom of the tube, all in one continuous stroke. Such a pointed blade tends to produce a nick in the end of the tube.

One way of getting around this problem is a double shearing action, where a small cutoff shearing blade comes in from the side, shears out a sector of the tube circle, then the larger V-shaped blade comes down vertically to enter the previous cut and complete it.

This is fast and accurate; up to 7000 2-in.-OD pieces of tubing with 0.05-in. walls can be cut to a 2-in. length in an hour, for example; or 6000 18-in. lengths.

FLYING CUTOFF SAVES TIME

If it's continuous stock that must be chopped to length, flying cutoff may be added to the end of a press, rolling, or tube-forming line. Tubing is most frequently cut off this way, but the process can be applied to fairly light solid stock, and strip, as well.

Flying cutoff with a shearing blade works this way: Stock enters a die that is mounted on a movable table, trips a gage, and starts the die moving along with it. As the die starts moving, the shear blade is released to cut straight down, as it moves along with the stock. The result is a straight cut, square with the axis of the stock. After the blade clears, heavy springs return the die and shear assembly to start position.

Shear blades are usually pointed in the center, and have a tendency to nick the end of a length of tubing. Accuracy for a blade normally runs around ±1/32 in.

Other tools for cutting tubing, which may be used on solid stock, too, are circular saws, and lathe-type bits or circular V-section cutters (like pipe cutters), which are powered by rotary heads. Pipe cutters tend to neck tubing slightly; lathe tools produce the cleanest cut.

Flying cutoff takes no time from a line where stock moves continuously and instantly changes continuous stock into lengths as desired, which may be fed to a conveyor or stacked under the unit. It isn't often applied to other than tube or strip stock, but it's a possible answer to the cutoff question.

HYDRAULIC SHEARING

Using hydraulic power for shearing has advantages in relative light weight of the equipment for a given amount of shearing power. There is no mechanical vibration present, nor flywheel effect. There may be some shock when the material finally parts, but the equipment itself has no build-in vibration as would a mechanical electric-driven shear.

For these reasons, portable hydraulic shears with 10-ton capacity are available, and larger semi-portable units with 200-300 ton capacity are built. Usually such a shear has a hydraulic cylinder that acts directly on one blade, while the other is supported by a heavy C-frame. These shears can be set up to operate without any foundation whatever—even supported from a crane in the larger sizes. Small hand-held units are usually operated from hydraulic pumps on carts.

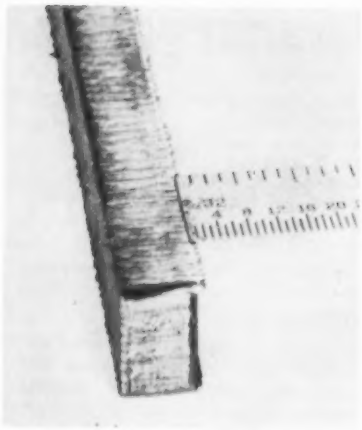
Friction Sawing Tears Metal Apart

All other cutoff methods depend on shearing action to create chips, but friction sawing is different. The principle is to run a blade at high surface speed into the work, which heats up rapidly because of rubbing (friction) action in a local area just in front of the blade. The metal softens and is torn away by blade motion, producing red-hot globules of metal instead of real chips. Sometimes the globules actually burn.

The trick is to heat the metal, but not the blade. A working blade may have a small spot of red just where it leaves the stock, but if the red spot lengthens out much, cutting pressure must be reduced. Otherwise the blade will be ruined. Feed rate must be firm, but not forced. If the blade is fed too slowly, the heat will have a chance to dissipate through the work; if too fast, the blade will break or jam.

Friction cutting is fast. In plain carbon steel, a bandsaw can cut 1/16-in. stock at 1400 ipm, or 1-in. stock at 6 ipm. Thicker stock takes too much feed pressure for hand feeding, and is usually moved by an hydraulic power table. By comparison, ¼-in. tungsten steel cuts at 38 ipm, and gray cast iron ¼ in. thick cuts at 55 ipm.

FRICTION BLADE WILL CUT MATERIAL HARDER THAN ITSELF . . . without trouble. Work here is hardened die member 1 in. thick. Friction bandsaws also cut milling cutters and files. For best speed advantage, bandsaw wheels should be large

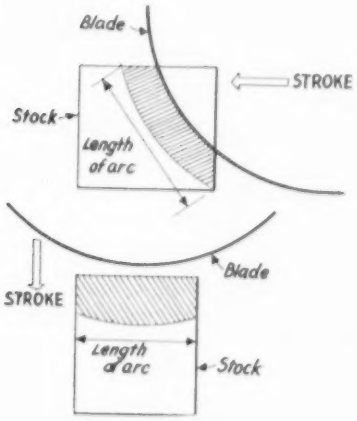


FRICTION-BANDSAWED STOCK . . . has ridged cut and considerable burr, but cleanup can be done with abrasive belt or with final machining operations. Considering cutting speed, even some precision parts might be economically friction sawed to rough shape, then finished

OPERATING FACTORS FOR FRICTION BANDSAWING

MATERIALS	Saw Velocity Work Thickness			Saw Pitch Work Thickness			Approx. Lin. Cutting Rate (in./min.) Work Thickness				
	1/16"-1/4"	1/4"-1/2"	1/2"-1"	1/16"-1/4"	1/4"-1/2"	1/2"-1"	1/16"	1/4"	1/2"	1/2"	1"
Carbon Steel (S.A.E.) #1010-1095	6,000	9,000	12,500	14	10	10	1400	60	30	8	6
Manganese Steel #T1330-1350	6,000	9,000	12,500	14	10	10	1200	55	25	7	5
Free Machining Steel #X1112-X1340	6,000	9,000	12,500	14	10	10	1400	60	25	7	5
Nickel Steel #2015-2515	8,000	12,000	14,000*	14	10	10*	800	45	20	5	3
Nickel Chromium Steel #3115-3415	8,000	12,000	14,000*	14	10	10*	800	45	18	5	3
Molybdenum Steel #4023-4820	8,000	12,000	14,000*	14	10	10*	1000	50	20	6	3
Chromium Steel #5120-5150	8,000	12,000	14,000*	14	10	10*	800	45	18	5	3
Chromium Steel #51210-52100	8,000	12,000	14,000*	14	10	10*	800	40	15	5	3
Chromium Vanadium #6115-6195	8,000	12,000	14,000*	14	10	10*	700	40	15	5	3
Tungsten Steel #7260-71360	8,000	12,000	14,000*	14	10	10*	600	38	12	4	3
N. E. Steel #8024-8949	8,000	12,000	14,000*	14	10	10*	800	45	20	6	3
Silicon Steel #9255-9260	8,000	12,000	14,000*	14	10	10*	600	45	16	4	3
Armor Plate	7,000	10,000	13,500	14	10	10	1200	60	30	6	5
Stainless Steel	7,000	10,000	13,500	14	10	10	1200	60	30	8	6
Illium	8,000	12,000	15,000*	14	10	10*	600	35	12	3	2
Cast Steel	7,000	10,000	13,500	14	10	10	1000	50	16	7	5
Gray Cast Iron	7,000	10,000	13,500	14	10	10	1000	55	20	7	5
Malleable Cast Iron	7,000	10,000	13,500	14	10	10	1000	55	20	7	5
Meehanite Castings	7,000	10,000	13,500	14	10	10	1000	55	20	7	5

HIGHER BLADE VELOCITIES FOR THICKER WORK . . . prevent heat buildup in blade. Starred cases can be handled better by rocking work so less than full work depth is engaged by blade at any given moment. Note tooth pitches—all within narrow range.



MAXIMUM ALLOWABLE ARC OF CONTACT

Blade dia, In.	Peak	Average	Heavy
24	3 in.	2 1/4 in.	1 5/8 in.
36	5	3 3/4	2 5/8
48	7	5	3 3/4
60	9	7	5

CUTTING CAPACITY OF CIRCULAR FRICTION BLADE . . . rises about directly with blade dia—which controls surface speed. Peak rating is only for occasional cuts; heavy rating for practically constant blade use

FINISHES NOT GOOD

Because there is no shearing action, accuracy isn't as good as with comparable bandsawing or circular sawing. The melting-tearing action results in heavy burr formation. But straight lines can be sawed, and a line can be parted with almost as much accuracy as with cutting teeth.

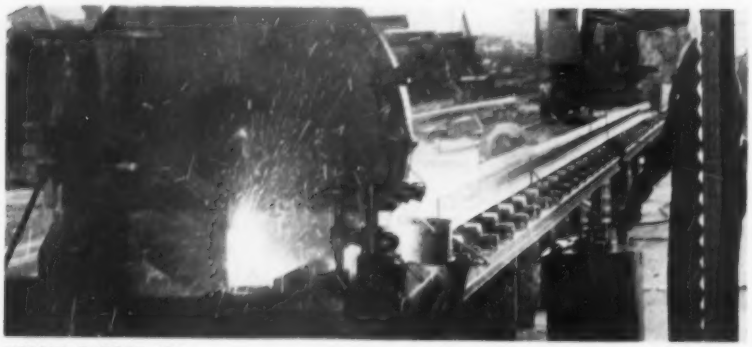
FRICTION BANDSAWING

Surface speeds for a bandsaw can range from 3000 up to 15,000 sfpm, depending on type of steel, thickness, and pressure exerted for feeding. Bandsaw teeth don't have to be sharp to produce good results; they are usually pitched at 10-14/in.

There have been times when ordinary steel strapping has been used on a bandsaw for friction sawing—with good results too. But one major trouble is smearing—producing an excessively long burr, even as much as half work thickness. Teeth gouge globules of metal out of the hot spot much better than a plain band. They also produce a higher unit feed pressure, which means higher heat and better cutting. In some cases a plain band will work, but for most applications it has too little strength and requires too high a feed pressure.

Feed can be as fast as seems workable, up to the point where the blade starts outrunning the hot spot where the stock is being softened. Actually a friction bandsaw can cut faster than a man can feed stock if the stock is thin enough. On ¼-in. cold-rolled steel a force of 20 lb feeds the stock at about 17 ipm when the blade runs at 5000 sfpm or at 31 ipm if the blade runs at 8000 sfpm. Twice the force almost triples the feed rate, with the same blade velocity.

One important advantage in bandsawing is that the same blade setup can be used for many different materials, if feed and speed are adjusted. Another point is that ordinary bandsawing can be done on the same machine; although not all bandsaws develop enough blade velocity to allow friction cutting. Contouring and radius work can also be handled on a friction



HEAVY CUTOFF JOB . . .
is 10-in.-sq box column with ¾-in. plates. Setup is at Kyle & Co, Stockton, Calif, where 100 to 300 cuts are made per day. Another plant uses circular friction saws on 80-lb railroad rails, making 800-1200 cuts/8-hr day. Production increase over power torches, hacksaws, and cold saws ranges from 25-60%

TYPICAL CUTTING SPEEDS FOR CIRCULAR FRICTION BLADES

Stock (steel)	Time, sec
24-in. I-beam	25
15-in. 55-lb channel	15
100-lb ARA rail	9
8x8x¾-in. angle	11
3-in. square bar	12
4-in. round	20
6-in.-OD tube, ½-in. wall	11

CUTTING SPEED . . .
for circular friction saw is indicated for common shapes of stock. Efficiency depends on getting through rapidly, keeping hot spot localized in front of blade and not allowed to dissipate throughout the stock

bandsaw, within accuracy limits depending on how much burr is developed and how well the operator can keep up his own accuracy and feed rate while making the curves involved.

NOT ALL METALS

Friction bandsawing works well on steel and iron, but not on many non-ferrous metals such as aluminum, brass, magnesium. Some plastics—thermosetting types filled with hard materials such as glass, mica, etc—can be friction sawed. Thermoplastics cannot.

Even hard, tough steels like armor plate, stainless, and hardened tool steels can be friction bandsawed.

Irregular parts, like auto bodies, and gates and risers on ferrous castings, are quickly friction sawed. Friction sawing, in general, can be applied to rough cutoff work, and often produces more accurate work than many rougher cutoff methods usually applied.

CIRCULAR FRICTION SAWING

Friction bandsawing can be done on a standard machine, as long as it has blade speeds high enough to create friction heat. Circular friction saws, on the other hand, are specialized equipment, requiring high motor power, accurate speed control, and a high-pressure water pump for blade cooling.

Surface speed of the blade is most important. The best range is between 20,000 and 22,000 sfpm; below this range cutting efficiency drops quickly and above it the increase is only gradual.

At this speed, saw teeth aren't always necessary; it depends on the carbon content of the steel being cut. For steel with carbon content above 0.6%, a smooth-rimmed blade works best. For carbon contents below 0.6%, the blade has hobbed teeth that look more like spur-gear teeth than cutting teeth. The front angle is positive, and the rear angle negative, but sharp cutting edges are not necessary. As with friction bandsaw blades, the teeth actually scoop softened metal out of the stock, but don't really shear.

Blades are medium-carbon steel, heat-treated, balanced, and hammer-tensioned at the rim. To make the front edge of the blade do the work, and to prevent the blade sides from contacting the work and thereby heating up, they are either taper or hollow ground. Taper grinding allows more regrinding because the side clearance angles stay the same.

Regrinding removes from 1/64 to 1/32 in. of metal. Normally a 60-in. (diameter) blade will cut through about 23,000 sq in. of steel stock before regrinding is required. A 24-in. blade will cut about 3600 sq in. per sharpening.

Although convection air currents set up by blade rotation do help some in cooling the blade, this isn't enough. Compared to a bandsaw blade, a circular blade has much more metal, and therefore retains heat better. If the blade should heat enough to lose its temper, it would probably be ruined completely.

For this reason a high-pressure pump and special water head are provided to impinge high-pressure water on the blade—usually at the rear of the machine. Heat is carried away in the water.

Ferrous alloys heat up to 1400-1800 F, at which point they soften enough to be torn away as the blade penetrates the stock. Little work has been done on non-ferrous metals; though experimenting has been done, and some tests with slightly different machines have shown favorable results.

LIMITATIONS

The heat problem is the limiting factor in cutting heavy stock, and heat goes up directly as the length of contact between blade and work increases. Thus a blade can be rated by maximum arc of contact with the work. This is a rough rating (see table, p141), so limits are usually indicated for constant and intermittent cutting.

Arc of contact can be controlled somewhat by the setup. A down-stroke machine, most often used for cutting bar, rod, angle, and similar stock, is set up for most efficient work by locating the stock directly under the blade arbor. This means the contact arc of blade against work is nearly horizontal. But a horizontal-stroke saw may be set up with work flat on the table and with the blade taking an oscillating stroke across it.

If only the outer edge of the blade passes through the work, the arc of contact will be a long, slanted curve. This may come close to the limit of arc of contact the machine will handle. On the other hand, the work may be raised to locate it closer to the center of the blade, making the arc of contact less slanted, and therefore shorter. Under such conditions, the blade could cut thicker stock.

Bandsaws Cut Any Shapes

Probably the most flexible single kind of machine for cutoff work is the bandsaw. A standard upright machine can do contour sawing as well as cutoff, and if there isn't enough of one kind of work to keep it busy full time, it can be switched to the other.

But a regular contouring saw has a serious limitation for some cutoff work. The maximum length of stock that can be cut off is only as long as the bandsaw throat is deep. On most saws the blade guides can be angled to twist the blade, which would allow cutting longer lengths. In this case the stock wouldn't have to enter the throat. But this change in setup then limits flexibility of the machine, and the practice is tougher on the blade.

A fairly recent development is a new saw design with the blade intentionally twisted so its face is in line with the machine throat. The blade comes down pointed directly away from the machine, but passes over the tires and through the back of the machine in the usual alignment. On this machine the limitation is in the distance to which work can be fed—also the depth of throat.

Normally cutoff work is done with a horizontal-frame bandsaw, which has a low table and blade-carrying arm that tilts much like a hacksaw frame. Usually the arm can be fed automatically—with hydraulic power or weights, and often the setup may include an automatic stock-feeding hydraulic table. With length stops set, and the machine turned on, it will saw through stock (a single piece or several pieces clamped together), retract, feed more stock to depth, and cut again. An operator would be required to load new stock in the vise and to clear away cut stock, but the machine would operate continually otherwise.

A power cutoff bandsaw can be used on rod, bar, tube, extruded, and any other stock to be cut to length, as long as it will clear inside the throat of the machine—or the throat of the powered frame.

BANDSAW ECONOMIES

Good point can be made of the thinness of the bandsaw blade—about 1/16 in.—if the work is a longish production run or in stock more valuable than common steel. It turns less stock into chips than most other cutoff methods. Of course for job lots and for trimming work (on parts that have flash to be removed, for example), the wasted stock doesn't make too much difference. But if the machine has to cut bar to length all day, the smaller loss of stock could make an economic difference.

Another economy for the bandsaw is that all teeth theoretically cut equally, which might not be the case with a powered hacksaw. Tooth wear should therefore be evenly distributed for longer tool life.

On the other hand, a modern hydraulic bandsaw is a complex mechanism, and capital investment may well be on the high side, compared to other possible machines. Thus, in the matter of overall economy, a balance should be made up for each major application, taking into consideration such factors as blade costs, machine utilization, relative labor requirements, and length of run.

Figuring tool costs alone (not counting operator time and overhead), an ordinary carbon steel might be cut at around 300 fpm (blade speed), with a cutting rate of perhaps 12 sq ipm. If blade life were around 7000 sq in., tool cost would run approximately $0.002 per sq in. of steel cut. Whether or not this would compare favorably with another method of cutting off would depend on the other tool cost and the amount of operator time involved, as well as many other factors.

IF IT DOESN'T CUT STRAIGHT

Bandsawing is one of the more precise methods of cutting off stock, but it is also subject to some special problems—many of them brought on by the fact that the tool is a thin steel band instead of a husky block of some kind. At high speed, with the blade under good tension, and with the blade guides set accurately, the blade has strength and rigidity. But if anything should upset the applecart, the bandsaw blade can snap in an instant, without warning.

For example, too-light tension on the blade, extreme difference in temperature—in the cut and out, guides set too far from the work to support the blade, guide misalignment, and hard inclusions in the stock being sawed are all possible reasons for bandsaw breakage.

If circles or curves have been sawed with the blade, particularly if the curves were mainly in one direction, one side of the blade (actually, the tooth edges on that side) will wear faster. If one side of the blade is dull, the blade will tend to cut in the direction of the sharp

HORIZONTAL POWER CUTOFF SAW . . .
slices steel blanks automatically, feeding stock up by means of hydraulic table. Accurate blade alignment is especially important in deep, interrupted cut, as here. If blade wave should develop through hole in stock, blade would surely snap

BANDSAW SPEED RECOMMENDATIONS

Material	Blade Speed, fpm	Notes
Aluminum	1500-3000	If over 3% silicon, 1500 max
Brass	500-1000	If hard or tubing, 500 max
Bronze	150- 300	If aluminum bronze, 150 max
Copper	250- 500	
Iron	75- 150	If malleable, max can be 200
Kirksite	150- 200	
Lead babbitt	1500- 300	
Magnesium	1500-3000	If rolled, forged; 2500 max
Monel	50- 100	
Nickel	75- 125	
Silver	150- 200	
Steel	50- 200	

SPEED-CHART SETTINGS . . .
can often be exceeded, but they're a starting point. This chart is for raker and wavy-set blades, for general production cutting, fairly hard materials, and good finishes. Skip-tooth speeds would be somewhat higher, for soft, stringy materials and fast thin-section cutting

side. In fact, an unevenly worn blade won't cut a straight line at all.

The operator may try to compensate for the blade wear by turning the blade guides slightly, but this is a pretty haphazard method, and it may strain the blade somewhat. Then, once the blade is replaced, the operator may forget to realign the guides, and will proceed to cut curves with a brand-new blade—only in the opposite direction from that before.

Even at the cost of reducing total blade life, a better solution is to intentionally dull down the sharp side of the blade to approximately the same poor condition of the worn side so teeth on both sides will cut about evenly. A blade dulled equally on both sides at least has a good chance to cut a straight line.

A blade that's been kinked and bent is ready for the scrap heap. Retempering and straightening equipment is costly and in most cases impractical.

A blade must also be properly tensioned, too. Once the new blade has been tightened so it describes a straight line from wheel to wheel, it should be given a healthy extra tightening to bring it up to the point where it won't weave and flex. Otherwise, it won't cut straight, and it will easily snap if it hits any small condition that would endanger it in any way.

Blade speed is important, too, just as surface speed has a critical bearing on the cutting action of any metal tool. On stainless steel, for example, a bandsaw blade may cut well up to a blade speed of 60 fpm, or perhaps 75 fpm, but above that glazing will set in and the blade will smear, rather than cut.

Feed pressure has some effect on cutting results although through a narrower range, proportionally, than blade speed. Ordinary metals can be cut with a feed pressure of around 35-45 lb, but most cuts should be started with a lighter touch to prevent shock to the blade. One exception should be noted: If the material has a strong tendency to work-harden, the work had better be forced right into the blade to keep the blade teeth from working lightly over its surface.

Feed pressure results in tool force—pressure of the individual teeth against the surface of the stock. If this is too high, it will deflect the blade—and probably break it. If too low, it will allow the teeth to slide over the work, resulting in work-hardening, tooth abrasion, and no results as far as cutting is concerned.

Some machines are hydraulically powered for practically all possible motions—frame feed, work-table feed, and blade motion. Others have the feed force provided by the counterweighted frame itself, controlled by hydraulic power that allows the frame to move down at each stroke. If the effective frame weight of the machine is too high, broken blades are almost sure to result, just as if too high a power feed was engaged.

BEST CUTTING CONDITIONS

Recommendations on speeds and feeds are often only a starting point, not limits. For example, one machine builder checked actual results on 5-in. rounds of SAE 1045 against his own handbook and found quite a spread. The book quoted 225 fpm (blade speed), 9 sq ipm (feed through the cut), and guessed at 4200 sq in. (total blade life). Actually, a test showed that 260 fpm cut at 12 sq ipm with 7600 sq-in. blade life. In many cases, experience with the machine, blade, and material will allow much higher cutting rates—providing the setup of machine and stock is correct—than are usually listed.

Aside from speeds and feeds, good cutting depends to a great extent on the choice of blade. Where stock is thin or has thin walls, fine tooth pitches are chosen to provide a generally accepted minimum of three teeth contacting the stock at any given second. When this isn't possible, the operator may switch to a coarse blade and jack up the speed, doing a rip-sawing job, in effect. It won't produce a good finish, but it will cut fast, perhaps allowing extra time for finishing.

Normal cutting in steels is done with medium-pitch blades, with 8-14 tpi. Aluminum, iron, and non-metallic materials are usually cut with coarse pitches—even as low as 6 tpi. The finer pitches—up to 32 tpi—would be reserved for thin stock and for fairly slow, high-finish cutting.

Blade set has an effect, too. For rough work, skip-tooth blades with wide spacing between teeth are applied. Raker set is normally for heavy cutting in fairly thick stock, and for high-production cutting. Most regular cutoff work is done with wavy-set blades, which have teeth that graduate in set from one side of the blade to the other.

Coolant helps cutting action in most steels, with stainless steel being an exception. Aluminum is another metal that runs better without coolant, in part because of its tendency to contaminate. One manufacturer has had good results with wax coolants in sawing aluminum billets, however. Coolants are not recommended for most cutting in high-speed steels and air- and water-hardening die steels.

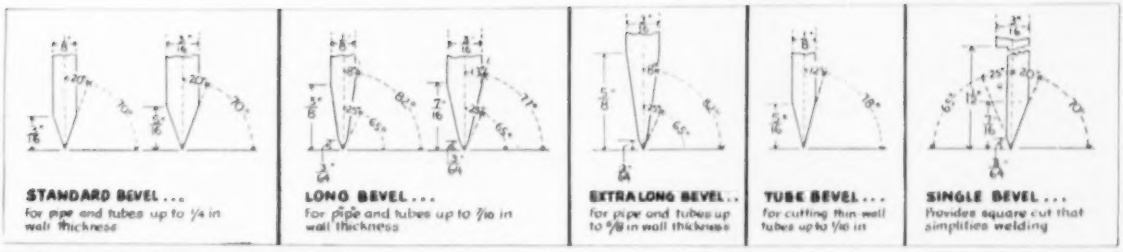
Abrasive Wheels Grind Through Stock

The fastest possible cutoff method on thin stock and simple sections is with an abrasive wheel, which works about like an ordinary grinding wheel. One important difference is that an abrasive cutoff wheel is usually fed through the stock about as fast as it can safely be pushed, which minimizes burning, work-hardening, and wheel loading.

Abrasive-wheel cutoff wastes more stock than sawing, but in most cases this method is applied to stock that isn't particularly high-priced, so stock cost isn't much of a factor. The advantages of fast cutting make up for any loss, particularly when the work is rough, or the requirements in accuracy are loose.

Fundamentally, a cutoff wheel is a grinding wheel with a width no more than 1/48 of the dia (according to American standards), or even less on largest-size wheels. It has to be treated with normal grinding safety precautions; perhaps more so than ordinary grinding because wheel speeds are high. Most wheels are marked by the manufacturer to indicate top operating rpm, which is a statistic that should be taken seriously.

At recommended speed, a cutoff wheel has high radial strength, and there's a reasonable margin left to keep down the danger from shock and vibration caused by grinding through the work. If the wheel should be run at a higher speed, most or all of its strength might be taken up by centrifugal force, and the least shock caused by entering the work could cause a disaster.



STANDARD BEVEL . . . for pipe and tubes up to ¼ in wall thickness

LONG BEVEL . . . for pipe and tubes up to 7/16 in wall thickness

EXTRA LONG BEVEL . . for pipe and tubes up to ⅝ in wall thickness

TUBE BEVEL . . . for cutting thin wall tubes up to 1/16 in

SINGLE BEVEL . . . Provides square cut that simplifies welding

WHEEL SHAPES DON'T VARY GREATLY . . . the important thing is that they be the same on both sides for straight cutting. The single bevel must be used in a machine with rigid spindle support—usually a column machine with back-and-forth motion that would prevent the wheel from wandering

Modern grinding machines are usually well guarded, and wheels always have some reserve strength, so abrasive cutoff isn't a dangerous operation. Of course there may be an operator who decides to live dangerously, in which case it isn't difficult for him to arrange conditions to provide an unusual thrill.

WHAT MACHINES?

Considerable amounts of cutoff work are done with small, portable power machines, which usually are equipped with reinforced resinoid-bonded wheels for dry cutting. The advantage of a cutoff wheel is that it will easily chop through thin and medium-thick sections of practically any material, and a portable machine is a natural for odd cutoff jobs around any shop.

Cutoff wheels can also be mounted on ordinary floor-stand grinders, in which case the work must be positioned manually. Some castings are trimmed this way (gates and risers), and stampings can also be trimmed.

For higher production, two general machine types are available. The chop-stroke type has a movable head pivoted so the blade can be moved up and down over a vise or other fixture. Some of these are air-operated, both in the head motion and in an auxiliary stock-feeding mechanism that will handle bar, tube, rounds, and pipe. Air vises simplify stock holding, and if properly aligned they eliminate some of the possibility of wheel breakage because of stock slippage. Size of stock that can be handled is a bit limited—usually to about a diameter of 3½ in.—because the size of wheel is limited by machine design and power, and because all of the wheel depth can't be used. Bracing collars or washers are necessary to keep the wheel from flexing and snapping.

Reciprocating machines run into larger sizes, with wheels up to a diameter of 26 in., which leaves about 8 in. of usable wheel depth for cutting. These machines usually have coolant fittings, and may be operated with the work completely submerged, and the wheel running constantly in coolant. This allows higher accuracy and better cutting action on some tough materials that wouldn't otherwise cut easily.

Both kinds of machines can be arranged with stock-rotating equipment to handle large rounds and pipe. If the stock is rotated, only half-depth penetration by the wheel is necessary, and twice the dia can be cut.

WHAT CUTS BEST?

An average abrasive-cutoff machine can cut about a fifth of a square inch of metal per minute. Coolant isn't always required, but it helps considerably to reduce work heating and wheel loading. Water or water-base emulsions are normal coolants, and they must be applied evenly to both sides of the wheel (by pipes or special spray heads) to prevent uneven wheel wear. If the wheel wears more on one side than the other, it won't cut straight except in especially rigid machines (reciprocating-head) where the head, spindle, and wheel itself have no chance to wander.

If stock is on the ductile side, coolant helps prevent loading. Another way to minimize loading is to use a grease stick, or choose a more open-grain wheel.

Wheel speeds range from under 7500 sfpm to around 16,000 sfpm, but each wheel should be operated in a fairly narrow range under the indicated top rotational speed. A slight decrease in speed will reduce cutting effect, but will naturally increase wheel life. An increase in wheel speed over design rpm is dangerous and should be avoided altogether. If more speed in cutting is looked for, try a different wheel type.

Most cutoff wheels are built with organic bond (resinoid, rubber, shellac), with resinoid usually operated dry, and rubber wet or dry. A resinoid wheel would be applied for fairly heavy cutoff work, running at 9000 sfpm up to the top limit. It would allow fast cutting, but would result in medium or heavy burrs, and—depending on stock material—probably burn.

Rubber bonds would be run at from 7500 to 12,000 sfpm, depending on wheel specification, with a good coolant flow. This would provide better accuracy and higher finish. For top accuracy, the work might be immersed and cut with a rubber-bonded wheel. About the best precision possible would be 0.008 in., probably attained with a fairly slow (5000 sfpm or so) speed.

Cutting with a coolant provides better wheel life and better finishes, but slower production. A considerable amount of portable-machine cutoff is done, and coolant can't be applied there. Such materials as plastics, ceramic, and various fiber compositions (all having a bad abrasive effect on metal saws), as well as many metals are cut this way.

ABRASIVE-WHEEL CUTOFF RATES

Material	Size, in.	Time, sec
CRS bar	1x1 ¼	5
CRS round	1½ dia	9
HSS round	1 dia	4
Steel pipe	2 dia	5
Stainless tube	1¼ dia, 1/16 wall	2
Angle iron	2x2x¼	5
Aluminum round	3 dia	9
Aluminum plate	1x96	43
Brass pipe	1½ dia	2
Copper bar	1x1¼	5

TYPICAL CUTOFF TIMES FOR CHOPPER MACHINE . . . Setup is usually fast and simple—most often with a vise and end stop to position work. Wheel is either hand or power fed—power feed will produce better surface finish in cut

As with any grinding wheel, a soft grit cuts faster and wears faster, a hard wheel lasts longer but doesn't bite as well. The harder the stock to be cut off, the softer the wheel should be.

Work must be clamped securely, and this is an important point because in many cutoff operations the stock is machine clamped, and only held for a couple of seconds. The length stop should be adjusted so it can't cock the stock, and the work must be supported so it doesn't vibrate. The machine itself must be in decent shape, too. Any side pressure on the wheel will tend to break it, because of the thin section and brittleness of the abrasive. Most abrasive cutoff machines are fairly light, compared to the average run of machine tools, and the forces involved in fast cutoff are unusually high. If everything is lined up on center, the operation can go well. Otherwise, trouble may develop.

Lack of horsepower can be an important reason for poor cutoff. If the stock (or head) has to be fed repeatedly or slowly, the chances are much more likely that the machine is underpowered than the wheel isn't the right one. Practically any wheel will cut to some extent, but if it stalls, the machine quite likely hasn't the beef to push the wheel through the stock. A 10-in. wheel operated at 12,000 sfpm, for example, requires a minimum of 2 hp, and 3 hp for good results. A 16-in. wheel running at 12,000 sfpm would require something between 7.5 and 10 hp. Check for worn V-belts.

Abrasive wheels should be stored flat and in a dry place. They pick up moisture easily, which warps them.

They can be dressed to a point (see sketches, p145), but dressing isn't necessary in all cases. After a wheel has gone through iron pipe, it will have a rounded OD that is just about what it needs for further cutting. The corners wear off first, which lets the cutting load distribute around a longer wheel section for later cuts. Sometimes a wheel may be dressed to an inverted-V contour for cutting pipe sections.

For standard cutoff work in metal, wheel sides should be fairly rough and have open grain. In general, dry cutting with resinoid wheels works best in carbon steels, steel pipe, chrome-nickel steels, and nickel. High-speed steel, tool steel, tungsten steel, steel tubing, and stainless steels should be cut wet with rubber wheels. Brass will cut either way.

Rubber-bonded wheels can be run dry when the area of cross-section of the cut is small, and if the material doesn't tend to build up heat much. Reinforced-resinoid wheels are stronger and tougher than ordinary resinoid wheels, and are best for materials that have inclusions, like castings and welded sections.

Wheel wear is something to watch if top results are expected. As the wheel wears, surface speed of the cutting section (OD) drops, and cutting efficiency drops fast. Frequent wheel changes from larger to smaller machines make sense and tend to keep performance on the larger machines constant.

One way to increase wheel life without changing abrasive grade is to cut through stock the thinnest way, keeping the area of engagement of the wheel with the work as small as possible. Wheel grains will have a better chance to cool this way. For the same reason, a wheel with low diameter works the grains too much, so wheel wear accelerates as the wheel wears.

Hacksaw—Workhorses of Cutoff

One advantage of hacksawing is the fairly low capital investment in the machine—although even a hacksaw can get expensive with elaborate stock feeds and complex automatic controls. Most hacksawing is done on bar stock or other solids, and the stock is usually heavy; so length of time in the cut is on the long side.

If the stock isn't thick, it can be clamped in multiple —and fed that way, too. Getting top economy out of a hacksaw means gripping as much stock as the blade will cut in one setup—or filling up the vise to the maximum capacity of the blade. Of course there are thousands of small and medium-size power hacksaws in toolrooms and tool cribs; and few of them are often strained to their capacity. But for production cutoff, the matter of blade utilization is quite important. A half-used blade isn't uncommon, but it's a sign of waste and lost production.

BLADES

Power hacksawing is usually done with HSS blades, sometimes tungsten steel if the stock is hard alloy or stainless steel, but most often molybdenum steel, which provides better toughness, wear resistance, and heat resistance. Standard tool-steel blades are sometimes used for soft metals, and quite often used for one-of-a-kind cutoff jobs in small shops.

Hacksaw teeth must be treated the same way as bandsaw teeth; in fact the rules were originally established on hacksaws. At least three teeth should engage the work; a cut should be started with the blade against a long surface rather than an edge; the blade shouldn't be too much longer than the maximum width of work.

Blade sizes range from around 12 in. long, ⅝ in. wide, and 0.032 in. thick; up to 36 in. long, 4½ in.

TROUBLESHOOTING LIST FOR HACKSAWS

Result	Cause
	chips overflow in tooth gullets
	Blade speed too high, heat dulls teeth
	Feed too heavy; chips overflow in tooth gullets
	Blade not lifting on back stroke
	Blade mounted for push cut, machine is draw cut; vice versa
	Insufficient coolant; overheating
	Wrong tooth size
	New blade in old cut; worn blade doesn't cut as wide as new
TOOTH STRIPPING:	Teeth too coarse for stock thickness
	Teeth too fine; gullets overloaded with chips
	Cut started on sharp corner, thin section
BLADE BREAKAGE:	Blade worn
	Feed pressure too heavy
	Teeth too coarse for stock thickness
	Teeth too fine; overloaded gullets
	Stock loose in vise; twists and vibrates
	Blade dropped on stock as arm comes down
	Blade tension too tight or too loose
	New blade used in cut started with worn blade
CROOKED CUTTING:	Blade tension too loose
	Blade wear uneven on both sides
	Machine worn, out of adjustment
	Feed too heavy
	Hard spots in stock being cut
	Blade improperly mounted in machine

wide, and 0.125 in. thick. Four major tooth sizes are available—4, 6, 10, and 14 tpi; and tooth set may be conventional or wavy, the wavy set being used mainly for cases where the saw has a tendency to bind.

Blade speeds don't vary a great deal, even in different materials. One blade-manufacturer's chart lines them up this way: (Mechanical saw)

Strokes/min	*Materials*
60-90	Alloy steel, die steels, forgings, HSS, manganese bronze, nickel alloys, stainless steel
90-120	Aluminum, brass, bronze, cast iron, copper, carbon tool steel, malleable iron, structural steel
120 and over	CRS, iron pipe, tubing.

Coolant should be applied whenever possible, except when cutting cast iron, which forms a sludge that retards cutting. Oil-water emulsions are most often used; coolant oils work, too, if they won't damage the metal.

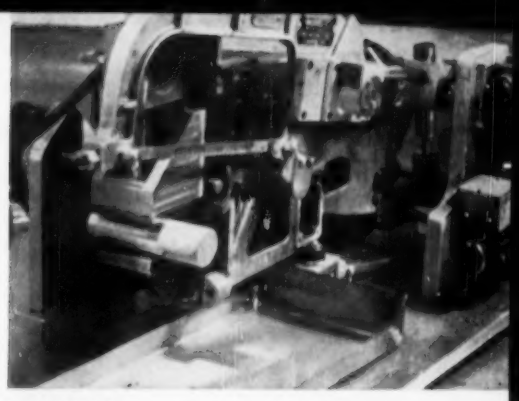
Blades are usually tightened by means of nuts, so torque wrenches are used to bring the blades up to uniform tension. Blade tightness depends mainly on blade size, unless cutting results indicate the blade should be either looser or tighter. Roughly, a 1-in.-wide blade should be tightened to around 96-120 in.-lb; a 2-in. blade to 320-440 in.-lb.

While cutting, the hacksaw blade actually curves somewhat because of the heavy force it exerts on the stock. Some bowing is allowable, but if it results in blade flexing to any extent, the blade should be tightened, or a huskier blade should be installed.

There are plenty of ways a hacksawing job can go wrong; a lot of them are concerned with the blade alone. One way to cure some of these troubles is to to apply a heavier blade; but this might bring on another danger. If a small piece of work is being cut, and the blade is too long, the blade may be snapped by the high feed pressure necessary.

Blades are held by pins through holes in their ends, and if the pin dia is much smaller than the hole ID, the ends of the blade may break out.

One trouble with hacksaws is that the blade has a fairly short stroke—an average machine might have a stroke of 4 in.—which means that if the work vise is fully loaded, the middle parts of the blade never get out of the cut until the work is fully parted. Molybdenum HSS blades help to overcome this effect because of their heat resistance. But this is an important reason for good coolant application, and for making sure the coolant actually gets into the middle of the cut, where the blade is working.



ALL-POWERED HACKSAW . . .
cuts off radioactive stock in "hot cell". Basically the machine is a simple hacksaw, but remote-control motors adjust vise position, backstroke positioning, and arm lift

CUTTING TIME AND SETUP DATE FOR HYDRAULIC HACKSAW

Material SAE—	Size OD, in.	Time Min	Speed spm	Feed Lb	Blade life sq in.
1020	1	0.26	140	175	2000
	2	0.97	140	250	2000
	3	1.76	140	300	2000
	4	3.14	140	350	2000
	5	4.90	140	350	2000
	10	22.44	130	325	1850
1040	2	0.63	140	250	2200
1060	2	1.05	100	250	1700
X1012	2	0.63	140	250	2500
X1335	2	0.63	140	250	2400
2340	2	0.97	130	250	1800
3140	2	1.05	130	250	1500
4150	2	1.25	100	250	1100
52100	2	1.57	85	250	800
6150	2	1.40	100	250	950
71660	2	1.57	100	250	900
9260	2	1.57	85	250	800

CHARTED CUTTING TIME . . .
is well on conservative side. Data for various steels is in roughly same proportion as detailed information given for SAE 1020. This material is for hydraulic-powered saw

Circular Sawing—Cold Sawing

One feature that distinguishes circular saw blades is the large number of teeth—often over 100. And though some cold sawing is done at speeds as low as 15 sfpm, it can also be done at speeds up to 20,000 sfpm. Speed depends mainly on the material being cut; in no other process does the speed vary so much.

Many circular sawing machines are built to take either an abrasive wheel, for steel in medium and large sizes and some hard non-ferrous metals; or a multi-tooth blade, for thin steel sections and most non-ferrous metals. On these machines the rotational speed is high and the cutting load per tooth is quite small. In some cases the surface speed of the blade may approach friction-sawing speed; but the blade is through the metal fast enough that burning and melting don't occur. If the metal is too thick, friction conditions may be approached, in which case the speed must be slowed.

Non-ferrous metals must be cooled at these speeds, and coolant flow is arranged to hit at the point where the blade meets the work. One line of machines is engineered for cutting steel (only thin sections such as light-wall tubing) at 20,000 sfpm with the blade, or at 16,000 sfpm with the abrasive wheel (the wheel has a smaller OD; spindle rpm's are the same). Brass and copper are cut at only 2400 sfpm with a much slower spindle speed, and aluminum is cut at 6000 sfpm. These are light-duty machines, and use saws with hollow grind and radial (no-rake) teeth (see sketch, p148).

How to Cut Off Metals . . .

CUTTING RANGES FOR CIRCULAR SAW (HEAVY DUTY)

Material	Speed (sfpm)	Feed (ipm)
Low-carbon steel, hardness 120-220 Bhn	40–120	2–8
Medium-carbon steel, hardness 160-240	35–110	1–7
High-carbon steel, alloy hardness 200-300 Bhn	15–60	½–3
Cast iron	40–60	4–6
Aluminum	2000–4000	50–100
Copper	1500–3000	30–60
Stainless steel	20–60	1–4
Brass	1100–2000	30–60
Magnesium	1000–3000	50–100

HEAVY CUTTING

Cold sawing on a heavy-duty machine is almost a horse of a different color, for appearances. The blade is usually large—16, 20, or 24 in. in dia; perhaps larger—and the rotational speed may be slowed way down. Chip load per tooth is fairly high—in the milling range. The blade will stand a heavy feed and long cut, in some cases without coolant.

Tooth profile has a sharply positive rake and curved gullet so it will develop good curled chips. One method of breaking up chips into sizes that will fall away readily is to have alternate teeth cut different shaped chips. One tooth has a square section (not counting a generous side relief) and cuts shallower; the other is beveled on each side and cuts deeper—producing two chips each time.

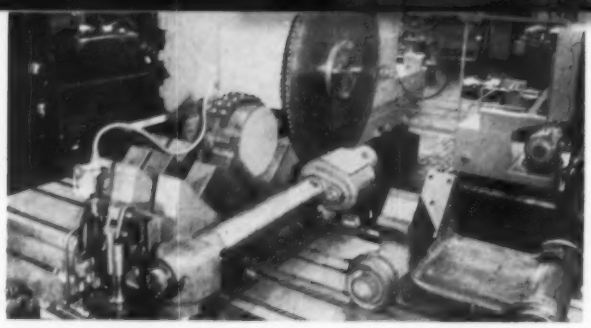
On a blade of average size—say 14-in. OD—the teeth would be 0.115 in. wide, and be available in pitches from 0.69 to 0.18 in., with from 64 to 240 teeth.

A typical production cutoff operation might require a 20-in. blade backed by 3 hp. On stock with a dia from ¾ to 4½ in., it would run at 9400 sfpm. The blade can be solid, which allows a thinner blade for the given dia; or may be segmental, which allows using HSS teeth—or individual teeth can be inserted.

Recent Developments

A report from Russia indicates that electrolytic grinding has been used to cut off railroad rails (they have high-powered units). There have been cases where special cutoff devices have been added to transfer machines, which, in effect, integrates cutoff in an automated setup. One such case is a circular-saw unit added to a lathe in an automated line; another is a cutoff machine added to a shuttle transfer machine. Electrical discharge cuts off radioactive materials in a remote-control setup using round-disk blades of various materials.

Practically any kind of machine tool or hand tool can be used for cutoff; but many of these are out of the running for production work. Chances are unlikely that a shaper or planer, drillpress, milling machine, boring machine, hydraulic press, or surface grinder would be useful for production cutoff. Yet, under special conditions, the possibility shouldn't be ignored. Cutoff is actually a simple, though sometimes tough, application for Metalworking machines. Yet sometimes cutting a straight line is the most difficult thing to produce.



HEAVY-DUTY COLD SAW . . . may be fitted with inserted or segmental teeth for billet cutting. Special stock-handling cart is installed to roll on rails. Large stock is gripped by roller chain in V-block with serrated teeth

LIGHT-DUTY SAW BLADE . . . has fine teeth to cut through thin tubing and light structural sections—not heavy, solid stock. For tubing under 2-in. OD, tooth pitch would be 3/16 in.; for larger tube, pitch would be 7/32 or ¼ in. Blade woud have diameter from 10-32 in. or so; thickness 1/16-¼ in.

COLD-SAWING ADVANTAGES

Circular sawing allows accurate cutting at a fast rate, and ordinarily results in a high finish. Blades can be resharpened, so tool cost should be low. It's possible to get stock welding on tool tips, of course, which calls for a lighter feed and better coolant application. If copper sticks to the edges, the blade can be chrome-plated. One particular advantage of circular saws is that inserted carbide teeth can be applied for extra hard materials or difficult cutting conditions.

Circular sawing machines can be built with swinging heads (like abrasive grinders), traversing heads over fixed stock tables, or with a stock-feeding table at right angles to the head-feeding motion. Power can be mechanical or hydraulic, and cold saws have been mechanized to the point at which after the stock is clamped on the table, an automatic cycle will control stock feed, saw feed, stock advance, saw retraction—everything except reloading the stock table.

We would like to thank the following companies for contributing information and illustrative material used in compiling this Special Report:

American Instrument Co
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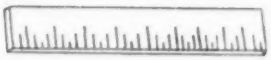
A yardstick for automation



How to measure automation? Here is a proposal, simpler than some being considered, that establishes five orders of automation. Includes some crystal gazing at the possibilities when the fifth order of automation is a commonplace

GEORGE H AMBER, PAUL S AMBER, consultants, DETROIT

A more concrete definition of every facet of automation is needed by the designers and users of automatic production systems. A dictionary type of definition does represent current usage, but is not enough for technical purposes.

The almost universal opinion in scientific circles is that not much is really known about a subject until it can be measured. No one has explained this more clearly than did Lord Kelvin in 1883: "I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it. But when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind."

As a start in developing a scale for "measuring" automation, let's find the "least common denominator," the basic indispensable factors of any job. This is simpler than it might appear, for there are only two such basic factors. No job, whether manual or highly automatic, can be accomplished without both factors. These are *energy* and *information*. *Energy* does the job, controlled by *information*.

The *energy* to do a job can be provided by either a man or a machine. In either case, this is only one grade of energy. It is either available, or it is not available.

Information, what job is to be done, and how to do it, can also be provided by either a man or a machine. But there are many grades of information, as will be shown, that can be used to control energy to accomplish a job. Classifying automation consists mainly of classifying the types of information that a machine uses.

A "beast-of-burden" can be used to provide energy, and even to provide some information. The milk-wagon horse (nearly extinct) who knows the many stops of his route is known to all of us. And how does a trained horse fit into the automation picture? Only to illustrate that there have been means of replacing man's energy, and even some of the necessary information in doing a job, for thousands of years.

Hand tools are definitely mechanical aids to man's working ability. However, hand tools do not provide any energy, and little, if any, information. They do greatly increase man's abilities to perform tasks, making many jobs possible, such as sawing wood, that cannot be done at all without tools. But hand tools have no self-acting qualities, thus they have no automaticity. Other mechanical devices, such as block and tackle, bicycle, jack, sling shot, and vise, are more than mere hand tools. These mechanized contrivances, in a broad general sense, are "hand-powered" machines. Here, too, however, the devices add no energy. They merely transform man's energy to a more efficient form.

In either case, hand tools and non-powered "machines" alike, the fact that they do not work by themselves and contribute no energy to a job, renders them zero automatic.

It will now be shown that each of man's faculties that can be performed by a machine raises the order of automaticity of that machine. Automation is here interpreted as being the summation of the individual automaticities of each station or machine in a manufacturing process.

We are all familiar with the character "F", used instead of Fahrenheit, when referring to a specific value of the temperature scale. The automation yardstick developed here makes use of a similar symbolic representation. The character "A" is used to represent the *automaticity* scale.

ORDERS OF AUTOMATICITY

The class of hand-powered mechanisms (which includes hand tools) that provide none of the energy, and only a negligible amount of the information required to do a job, can be shown symbolically as A_o. A_o represents the zero *order* of automaticity.

The simplest devices that replace any of man's efforts are the power tools. These provide most of the energy requirement, leaving man much less energy to provide. His duties when using a power tool are mainly controlling it and feeding work to it. Feeding work to the power tool, or the power tool to the work, still requires appreciable energy in many cases, such as when power saws are used.

However, the fact that one of man's faculties, that of providing energy to do the basic job, has been assigned to a machine, does give the machine a quality of automaticity. The familiar "holegun" handdrill, powersaw, jack hammer, cutting torch,

and even the punch press, are in the class of tools having the *first order* of automaticity. This is so because they replace a human faculty, the energy to do the basic job. This class is A_1.

The class of power tools that also possess power feed, such as radial drills, cutoff saws, and bench lathes, possess the *second order* of automaticity, A_2. These machines provide *all* of the necessary energy, for any given operation. Control is still the job of the operator, but once the work is in place, and tooling is set up, all he need do is start or stop the machine, or change controls.

Once we have power drive and power feed, the next logical step is to have the machine "control" itself. Machines that control their operations have the third order of automaticity, A_3.

At last man can stand back and see a machine do an entire job, without his intervention. The *information* on how to do the job, including the concept of skill, is built or set into the machine function, tooling, and control system. Examples of A_3 machines are automatic nail machines, automatic die-casting machines, and automatic-cycle machine tools. The clue is in the word *automatic*.

WHAT IS CONTROL?

Control in its simple forms consists of turning on or actuating a station; or as in the case of the turret lathe, transferring from one operation to the following one on the same machine. Obviously, a control function built into an A_3 machine, such as a modern automatic-cycle machine tool, can also be used to actuate the control system on a succeeding machine. Whenever we do have a series of A_3 machines with integrated sequential control systems, we have *automation*.

"Detroit" automation is largely of this type. Most of the individual machine tools are A_3. The machines are coupled together by conveyors, indexers, manipulators, and positioners. The "transportation machines" between the machine tools proper are also A_3. The proof that they are A_3 is that they are completely automatic, providing all necessary *energy* and *information* by means of built-in routing and guides.

Another form of A_3 machine is the special-purpose automatic continuous manufacturing machine. This type has for the most part machine-tool station and transportation elements all designed to operate as a single integrated machine.

The "information" built into a machine is really a form of *programming*. An automatic screw machine obeys the program, determined by the sequencing and set up of the tools on the turrets. An automatic milling machine may follow the program represented by a master profile. No machine classed lower than A_3 can follow any built-in program, no matter how simple it is. Such A_3 programming is always accomplished by "hardware," straight mechanical, electromechanical, or electrohydraulic.

Whenever the machining program is in the form of paper tapes, punched cards, or other programs that are not physically set into the machines, automaticity greater than A_3 is usually required. This is so for two main reasons. One is that some computations may be necessary in following non-hardware programs, as from paper tapes. The other reason is that machines using "paper" programs are usually of the closed-loop, self-correcting feedback type.

For all practical purposes, today's automation is almost entirely A_3. Functionally, the various machines are usually arranged output of one machine, to the input of the succeeding one. On layout paper, such automation resembles the "tails and trunk" arrangement of circus elephants on parade.

We know that complex A_3 automation systems "obey" the program designed into them faithfully. Too much so at times. The principle drawback of A_3 is this "blind obedience" characteristic. The machine goes right ahead, even if the tool is defective or the parts fall outside of limits.

This characteristic of not automatically checking up on results is called "open loop" by control designers. The A_3 machines are all "open loop," excellent for most routine heavy manufacture—not quite precise enough, or sufficiently flexible, for some high-accuracy requirements.

Machines that check on their work can be said to have some "judgment." These completely automatic "closed-loop" machines possess the *fourth order* of automaticity, A_4. They monitor their own output, automatically making corrections to their settings as necessary. Or, as in the case of some automatic honing machines, they continue with their function until the part is to proper size. A_4 machines of the self-correcting type, are most frequently encountered in continuous processes. To be properly A_4, the feedback (self-correction signal) must refer the work proper to a standard. Any necessary linear corrections can be made by means of power servo actuators. Incremental corrections, more frequently attempted in machine tools thus far, are accomplished by "stepping." In either case, an incidental self-regulating feature of a machine, such as speed, temperature, or voltage, does not necessarily make it A_4, as the work proper is not directly affected.

PROBABILITY EFFECTS

The dimensions of parts produced on a machine usually exhibit a "natural tolerance" caused by the organic "non-assignable" variation of the machine. Therefore, the dimensions of individual parts are usually at random, within the machine's dispersion zone, following the normal probability curve. The size of any individual part may fall anywhere from the high- to the low-tolerance limit and still be acceptable. Having a sensitive, closed-loop, self-correcting A_4 machine respond to individual measurements will only cause it to "hunt" from one dimension to another. The outcome is that the machine's dispersion pattern is amplified! The closed loop self-correcting A_4 machine could produce more rejects than a conventional A_4 machine, without feedback, if the A_4 control system is not adequate.

One practical solution towards having self-correcting features, without being "distracted" by the normal *range* of measurements, is accomplished when the machine "remembers" a part dimension, and does not initiate corrective action until two or more parts indicate a definite trend or drift that must be corrected.

Another solution is to compute the *machine-mean*, the centerline of machine performance, for use as a self-correction index, instead of using an individual measurement. This can be accomplished by means of built-in special-purpose analog computers. The computer calculates the machine-mean by averaging individual measurements. An advantage of a computed machine-mean is that the same computation is usable for an automatic quality control computer.

FIFTH ORDER OF AUTOMATION

A computer in a machine's functional or program control system indicates that it possesses the fifth order of automaticity, A_5. Machines of the fifth order of automaticity do not depend on a direct control or feedback signal. Instead, these A_5 machines respond to a mathematical function of either the control or feedback signal.

A_5 machines could compute the *machine-mean* to be used as a reference for self-correcting machines, or to be used for further automatic quality control computations. The possibilities for A_5 machines, based on computer control, are endless.

Other examples of A_5 machines with built-in computers are a machine that would automatically "optimize" by solving maximum vs minimum relationships. In plain words, machines with small built-in special purpose computers can do some of the routine "design" of the product they produce. An example would be a punch press that automatically positions the stock so that the maximum number of piece-parts could be stamped out of the minimum amount of stock.

A machine tool with a built-in automatic machinability computer would be another example. Such a machine tool would remove metal at the fastest permissible rate, taking into account the tool, surface speed, material, and other machinability variables, even if they are continually changing.

The next big step in automatic machinery, and automation involves A_5 machines. True, they may be years away, but only because of the normal inertia of industry, and the big investment in machine tools. But the trend is toward A_5. What is more, the techniques and "hardware" for making up the many small analog computers so necessary to A_5 machines, are already at hand. So a peek at two admittedly futuristic A_5 machines will be of interest.

It is entirely feasible to design a steel mill to roll beams having the optimum cross section. This rolling mill would automatically adjust the spacing between the rolls according to the output of a computer. The computer would accept span and load factor settings and work these into beam dimensions by solving conventional beam formulas. The result would be beams with the optimum cross section and moment through each point of length for the design shear and bending loads or allowable deflections.

In this way, using computers to control the mill, custom beams could be produced as readily as standard I-beams are rolled at present and at considerable savings.

A good part of automation today consists of moving parts around so that the proper part is at the correct station at the right time. This is accomplished in most part by conventional methods using shuttles and conveyors. Once these conventional transfer devices are designed and installed, the system becomes entirely inflexible. Any significant change in product or process requires radical redesign of the transfer equipment.

This can be avoided by the use of elementary military fire-control practices to sort and position parts by selective, controlled, catapulting. Yes, this is a bold move.

A machine of this type would defy obsolescence as it could readily be adjusted by merely resetting dials when so required by product changes. In this way it could accommodate and position a wide variety of stock to an unlimited number of stations.

By means of an aerial transfer machine, parts in process would be "lofted" for three-dimensional positioning. A somewhat simpler version would be to "kick" the parts across a free surface table for two-dimensional positioning and timing. This represents precision control based on the basic concepts of ballistics and bombing practice.

The shocks can be kept as low as necessary on both the catapult and receiver ends. In addition, the receiver need not be stationary, but can be a moving station on a turntable. This setup requires computers to solve the simple ballistics equations to determine proper catapult exit velocity, angle, time of flight, and "target" lead angle. The mass of each item can be preset on dials or obtained by automatic weighing.

HOW TO SOLVE PROBLEMS

Most of the solutions can be accomplished by items on the electrical designer's shelf, such as potentiometers, amplifiers, resolvers, and motors. Needless to say, the mechanical side of such a machine is a challenge to any machine designer.

Practically speaking, A_5 machines, those whose function are controlled predominantly by means of computers, are all we can expect to see in industry, in our day. Higher orders of automaticity will appear earlier in non-industrial machines. For the most part, these are at this time "paper-talk" systems, not immediately practical.

We have now separated automaticity into discrete steps. Each increasing order of automaticity indicates that an additional level of human activity has been replaced by the machine. The graduations, the *orders* of automaticity, form a basis for an automation yardstick.

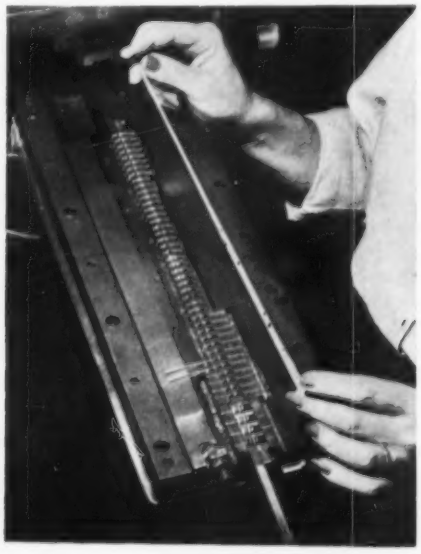
Practical Ideas . . .

FROM HEWLETT-PACKARD CO, PALO ALTO, CALIF

These pages mark a single-issue radical departure from familiar *American Machinist* practice. All the items here are from one company, but they cover the usual wide range of operations and tooling. They are the result of a machine-to-machine survey with the assistant production manager, Stan Selby, and other engineers of the Hewlett-Packard staff. For earlier, but specific, articles from the same company, see AM-Feb 1 '54, p 97; Feb 15 '54, p 134; Apr 25 '55, p 116.

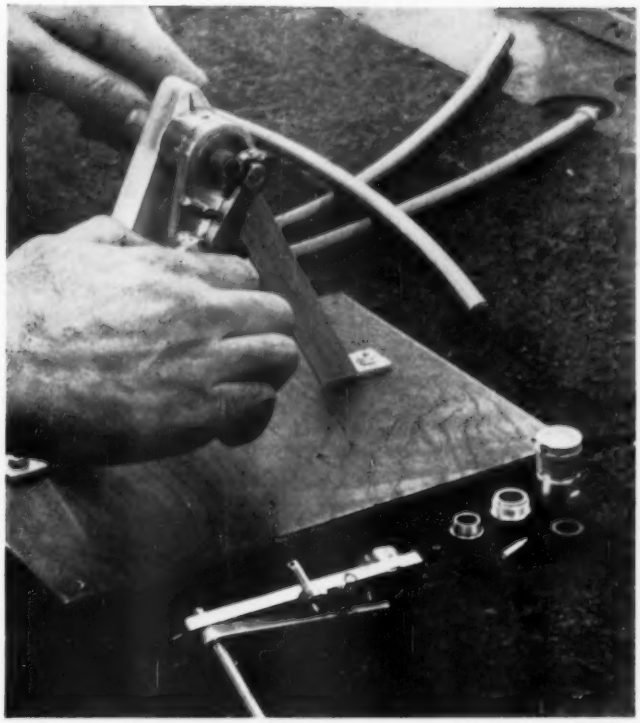
46 Varied Components Readied for Assembly at Once

COMPLETE SET of 46 resistors, of various values, are mounted in order on a length of masking tape, with leads cut to length and bent to shape, all mechanically, by this new system. Component misplacement has been cut almost to zero and laborious hand operations cut out. Shown here are 50 resistors, hand-inserted in a section of corrugated cardboard, being loaded into magazine, using inserter guide of metal. Operator has, in the same manner, loaded 45 other magazine slots with resistors of proper values



LOWER DIE on a modified Famco press is really a slide, which can be moved under magazine so one resistor of proper value drops into each nest. This is then rolled under male die, and one press stroke cuts and bends 92 leads. Here cradle is ready for unloading. Masking tape is applied to pick up all at once—and in proper order. Output is two finished strips per minute. Previously, resistors were lined up on tape, leads cut on a paper cutter and bent on a sheet metal brake. Components were inserted via assembly line

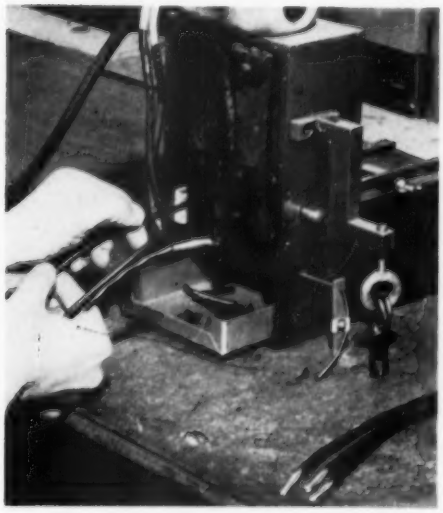
TAPE ENDS ARE WRAPPED, five deep and ten across, around dowels in a square frame, and ordinary bill clips hold the tops securely. This frame is supported in an inclined plywood rack at assembly. Operator inserts all resistors, taking them in order from tapes. System is self-checking, cutting component misplacement to near zero. Extra dividend comes in worker satisfaction resulting from enlarged production. Tooling costs were about $3000. Engineers are presently working towards a setup with flexible magazine, ram and cradle, so varying patterns of resistors can be handled with minimum changeover time



Rotary knives remove insulation

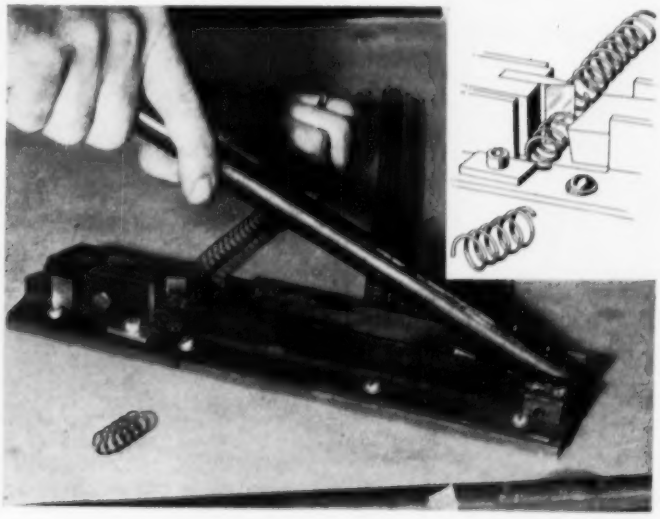
ROTARY KNIFE, designed to cut cable insulation prior to assembly of coaxial cable connection, has reduced assembly time two thirds over previous method. Two knives are used, one to cut outer coating, and the second (shown in foreground) to strip inner insulation. Depth of cut can be adjusted with screw to within 0.001-in. tolerance to avoid weakening shielding or wire

SHIELDING is laid back with the thumb, with an assist from a knife to start separation. Former procedure called for cutting away insulation with a razor blade, unbraiding and laying back shielding with knife. The use of a rotary knife assures a true perpendicular cut, allows cable to butt squarely against internal shoulder of connector



Pedal-operated stripper . . .

. . . takes off plastic insulation, does not mar shielding. Heat is provided by soldering-iron elements. Here ¼-in. coaxial cable is being stripped. Three other blade apertures allow stripping of cables from 1/16-in. dia to ⅜-in. dia wire

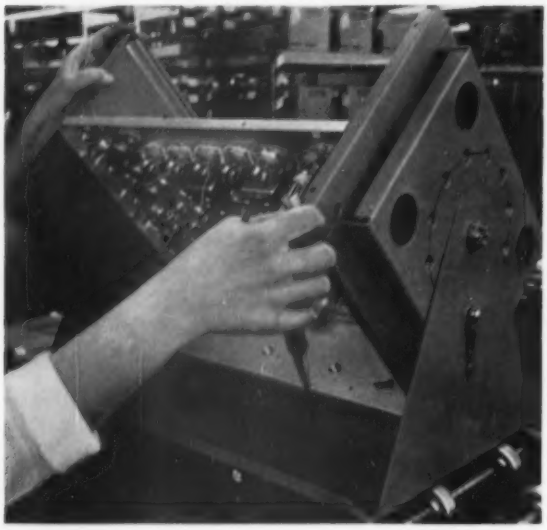


Cutter for springs . . .

. . . is more convenient to operate than side cutters. Anvil bar is moved by hand lever to force spring against cutter blade. Hardened blade can be removed for sharpening. Fixture has gage adjustment for springs of various lengths

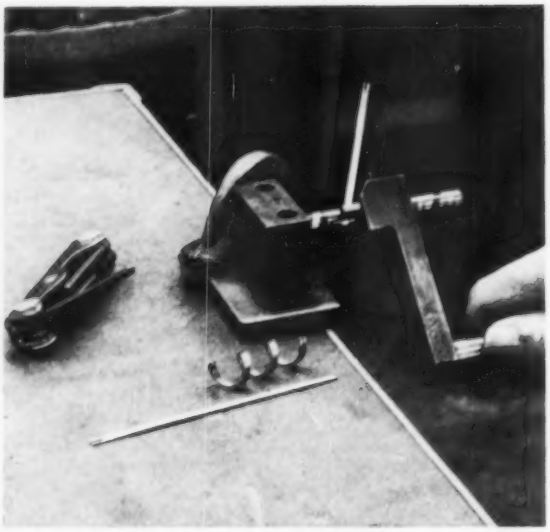
PLEASE TURN PAGE

Practical Ideas... FROM HEWLETT-PACKARD CO, PALO ALTO, CALIF



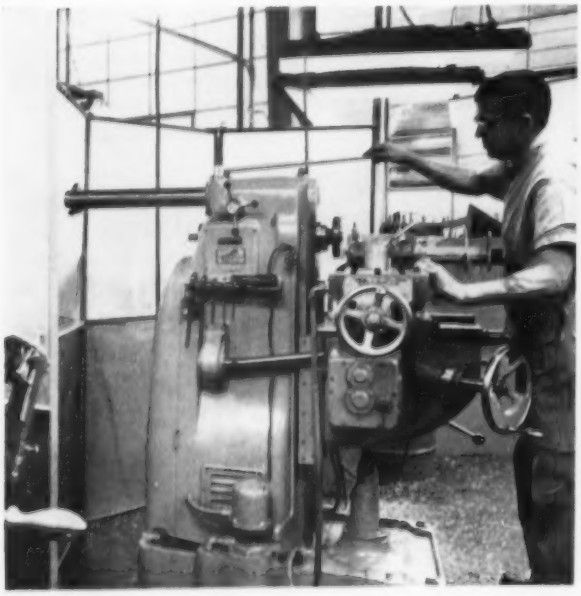
Trunnion fixture . .

. . . for assembly of chassis provides 12 work positions, 30° apart. Beryllium spring holds ½-in. bearing ball in indent at any chosen position, for operator's best working angle. H-P is presently designing an improved cradle, open ended with a T-frame



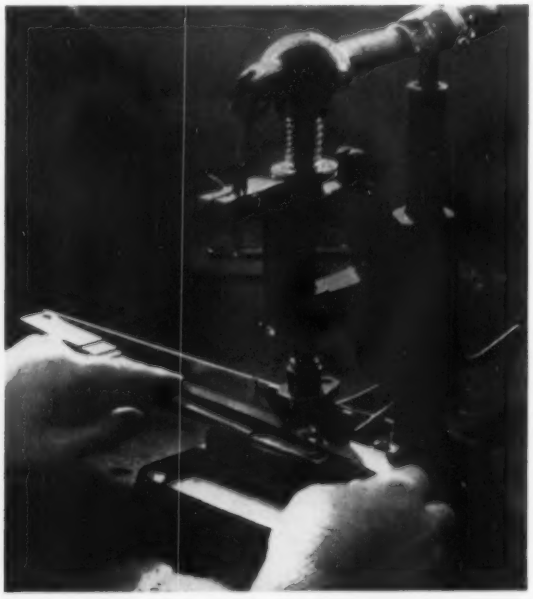
Precision winding of strip . . .

. . . into helix is done on simple fixture. One end of strip is inserted into spindle grooved with desired helix. It is held in place by a setscrew, then wound into shape by the crank with projecting pin. In foreground are a finished helix and a strip before winding



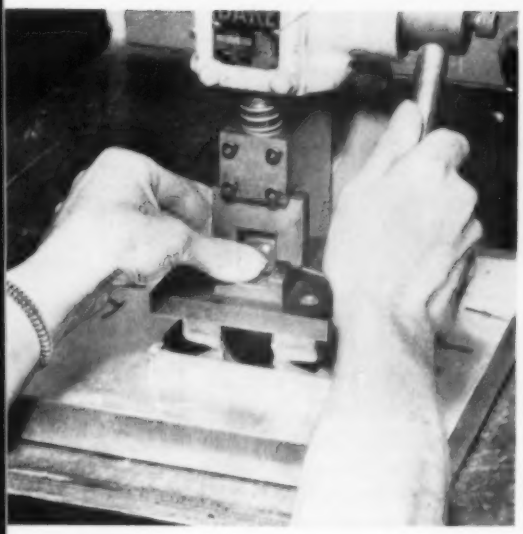
Flying chips or hot-metal splash . . .

. . . from solder pots must be stopped by guards or screens. Original ones were of sheet metal on angle-iron frames. They gave operators a closed-in feeling and cut off light. Glass-fiber panels in the top section give the necessary protection and do not cut off light, thereby creating a feeling of space. Bottom of screens are still paneled with sheet metal. Plexiglas was used at first, but showed scratches and was discolored by oil



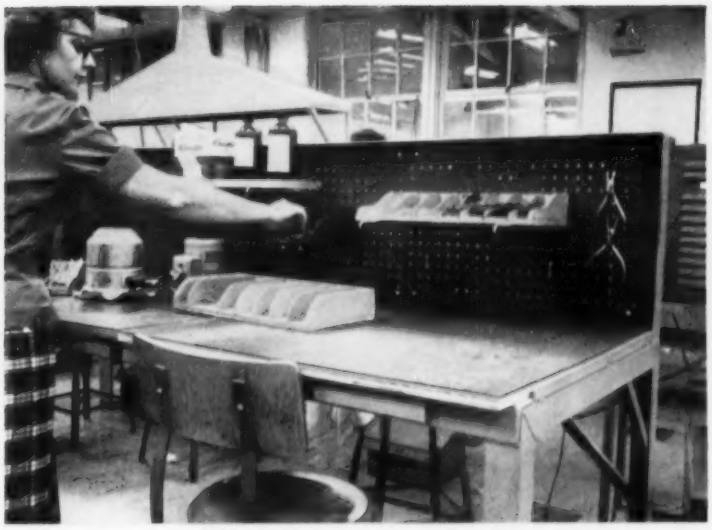
Notching press . . .

. . . cuts notches in fiber resistor strips for positioning of fine wire on both edges. Cuts are located by butting strip end against a series of gages, set up easily stacking standard gage plates on a common pin. This setup can be varied quickly by plates with desired distance from end to pin hole. Notchers in punch are tool-bits with 1/16-in. cutting edge



Cutting and bending . . .

. . . leads on capacitors is done in arbor press fitted with suitable die. Previously, leads were formed and cut with pliers, at a rate of about 100 per hour. New system is easier on operator, who turns out 100 in 15 min.

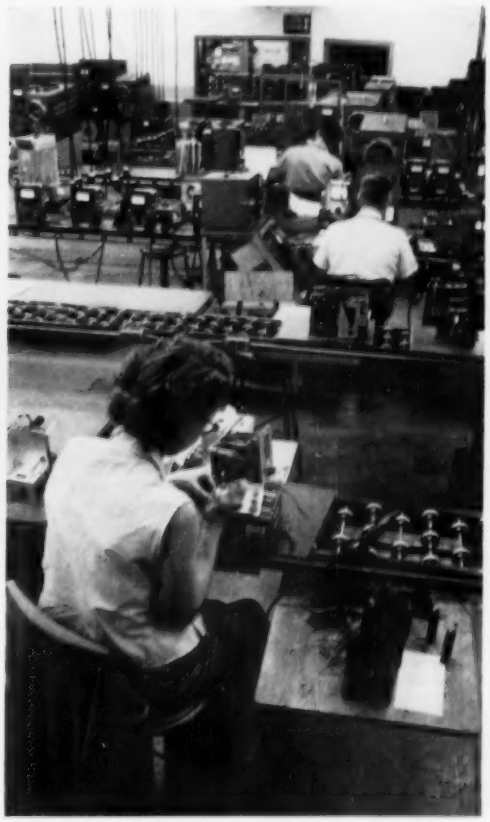


Peg board backs . . .

. . . on assembly table frames allow shelves and tools to be hung where needed, moved whenever necessary. Masonite-covered table top is of standard size so it can be removed and replaced by other tops with holes, tools or fixtures mounted and ready

Standard parts, outriggers, make assembly line

COMMERCIAL ROLLER-CONVEYOR SECTIONS form an assembly line. Outriggers are clamped to either side of the frame to hold tools or supplies. They are ¾-in. plywood with a length of 1x1-in. angle iron fastened on the far end to form a hook on top, hooking into edge of conveyor. Two lengths of strap iron support outriggers on its working side. Line is used on assembly of 50 or more units, saves 20-30% in labor time over previous system in which work was pushed along tables

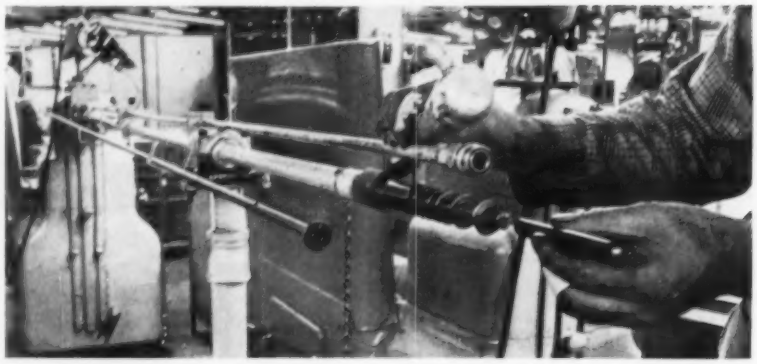


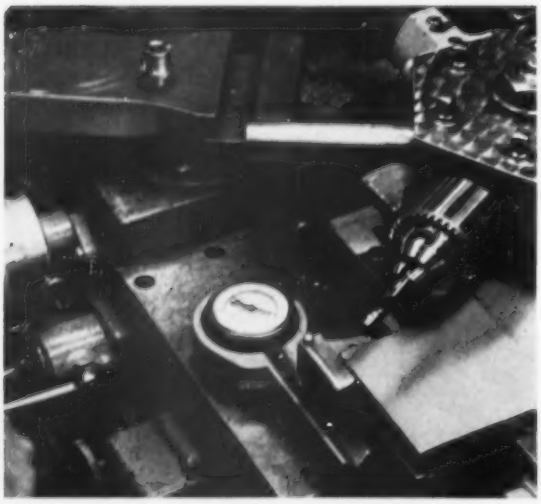
PLEASE TURN PAGE

Practical Ideas... FROM HEWLETT-PACKARD CO, PALO ALTO, CALIF

Stock feeders . . .

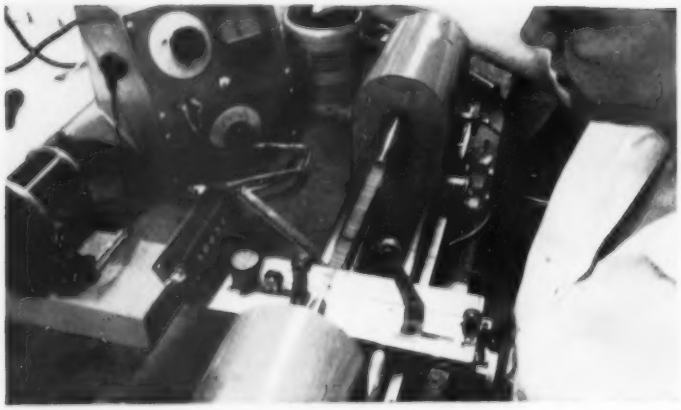
. . . for screw machines feed 12 ft of stock from ¼-in. to 1-in. dia without noise or vibration. Its success lies in the use of telescoping tubing with I D 1/16 in. greater than diameter of stock. Plunger in end and screw-on cap prevent escape of air. Feeding is done with low air pressure; 10 psi for ¼-in. stock, 4 to 5 psi for 1-in. Machine does not have to be stopped to advance bar





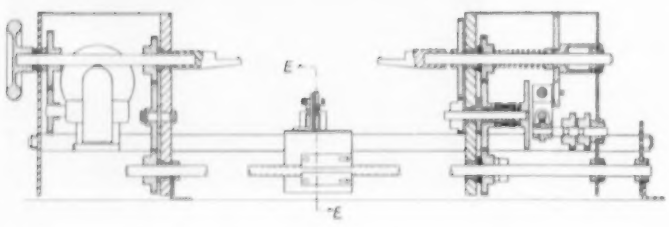
Dial indicator . . .

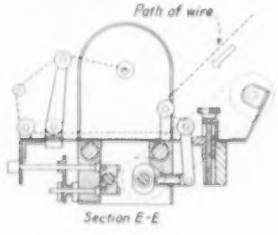
. . . installed on lathe turret assists high-speed production of precision parts. After turret stop is set approximately, indicator is used to attain precise adjustment. By conventional method, operator would depth-mike part, would sometimes miss, and have to redo. Once settings are found, operator can turn out parts to 0.0005-in. accuracy (from one shoulder to next, or from one bore to another) rapidly, three or four times as fast as with ordinary methods



Twin headstocks end wire drawing

WINDING LATHE for resistor strips solved many problems. Double-headstock lathe eliminated torque drawing of 0.001-in. wire in feeding, a problem with single headstock. Cam in pulley system takes up slack in wire as strip revolves, avoids continual jerking which, through slight, would tend to draw or break wire. Resistance of wire per turn is known, so each section of strip is wound to a specific resistance, checked by revolution counter in background. Operator makes final corrections by hand, unwinding or winding turns of wire on the ½-in. strip. Gearing (sketch) varies speed of lathe, permits overlap wiring and adjusts spacing between wrappings. Note wire path from spool to strip





INGERSOLL

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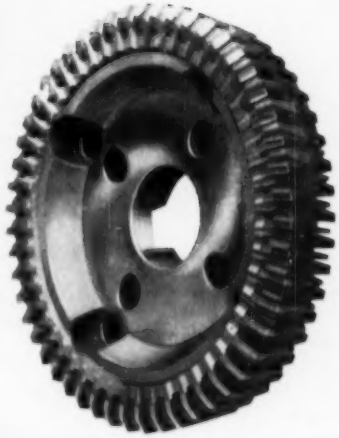

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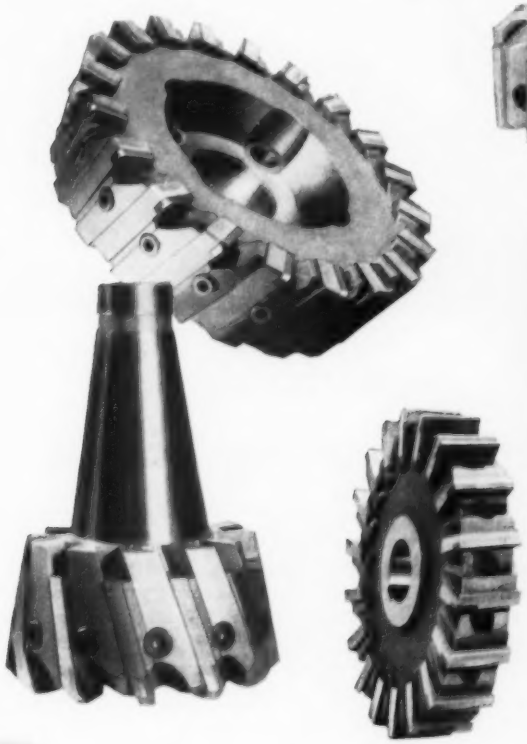

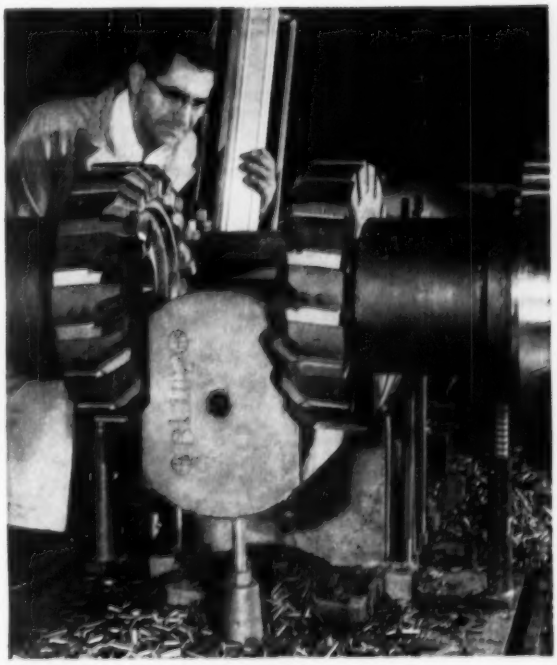

WRITE FOR CATALOG 66K

Write for Cutter Catalog 66K, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters and boring heads.

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American Machinist REFERENCE BOOK SHEET

GEAR TOOLING . . I

GLENN TINKLE, gear engineer, ILLINOIS TOOL WORKS, CHICAGO

Cutting tools for production of generated shapes have undergone tremendous development in recent years. Demands of the mass-production industries have been for lower-cost, more-accurate spur and helical gears in the 4 to 20 DP range. Selection of tools for such gears is a complex problem and is the subject of these Reference Book Sheets.

SELECTION OF CUTTING PROCESS

Most spur or helical gears of 4 to 20 DP can be cut by form milling, hobbing, or shaping, but the latter two methods account for nearly all high-volume production. Form milling is most commonly used in toolroom and experimental work. A formed-tooth profile is correct only when precisely located, and form-milled teeth are commonly subject to errors in position both radially and laterally. Appreciable tooth-spacing errors are also likely. Only exceptional rigidity throughout the entire indexing train will prevent significant tooth-to-tooth spacing variations.

Hobbing and shaping are inherently devoid of these sources of error. Trueness of the involute profile is independent of depth of cut and, except for very coarse-pitch gears of few teeth, there is no problem of centering. In generating, cutting is done in all positions as the cutting-tooth form moves through the work space. Spacing is as accurate as the machines and tools.

Factors affecting tool-travel clearance are different for helical and spur gears in each method of cutting. For spur gears, shaping requires the least clearance. In the case of helical gears, generating by either shaping or hobbing generally requires more clearance than form milling.

End clearance required for hob-

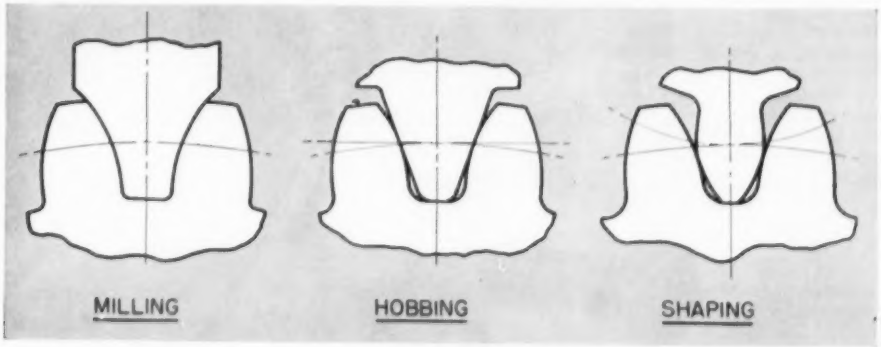

FIG. 1 . . Tooth forms produced by gear-cutting processes

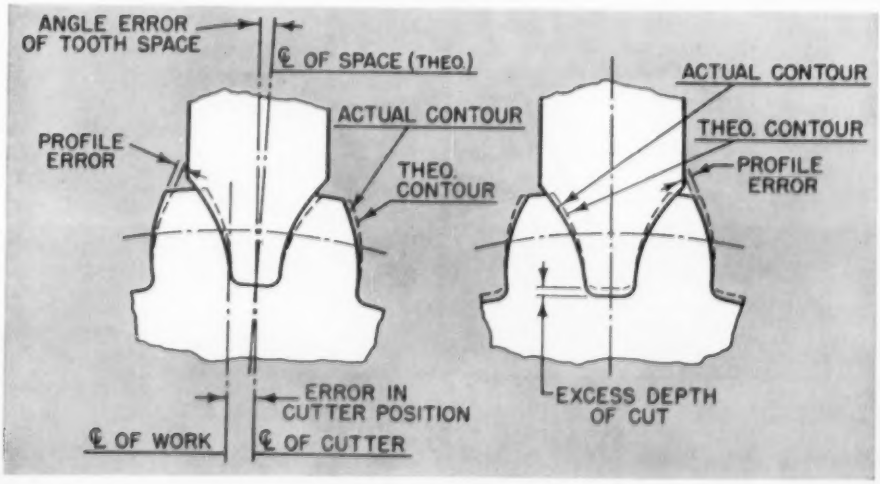

FIG. 2 . . Errors in form milling arise from failure to center the blank with the cutter or from setting the cutter at incorrect depth

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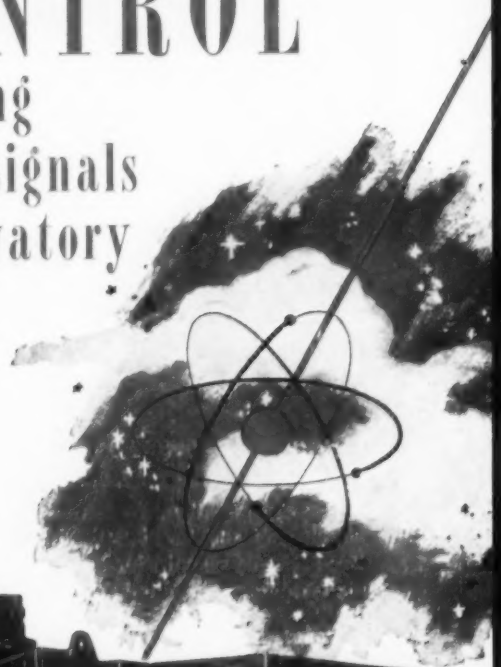

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GEAR TOOLING . . II

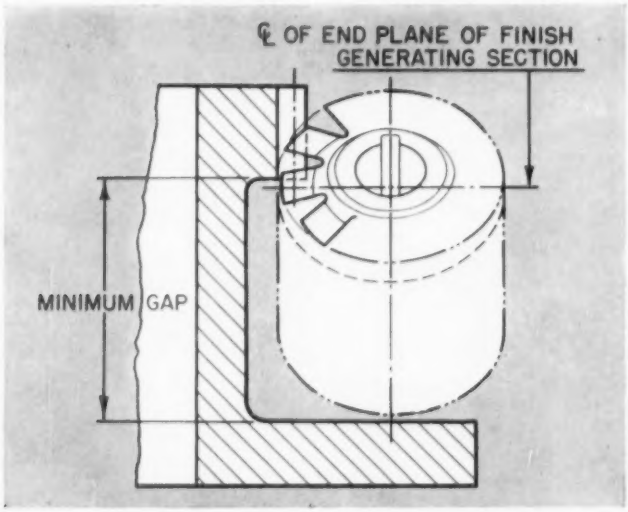


FIG. 3 . . Effect of hob-setting angle on end clearance. High setting angles require greater gap width

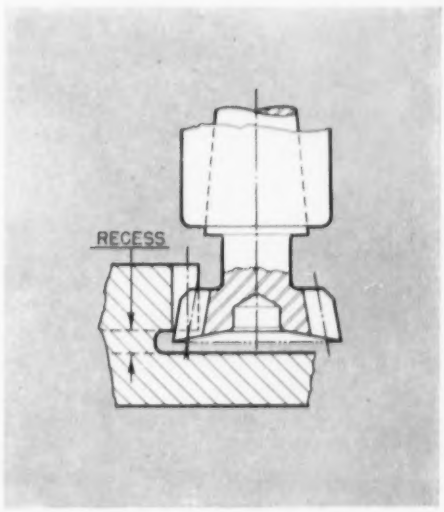


FIG. 4 . . A chip-clearance recess is necessary when shaping a gear with "blind side"

bing varies with the hob-setting angle. For spur gears this setting angle is the thread angle of the hob. For helical gears, the hob-setting angle differs from the thread angle of the hob by the value of the helix angle. Because hob thread angles are generally much smaller than gear helix angles, the obliquity of the hob, and therefore the clearance required, is generally greater for helical than for spur gears.

Multiple-thread hobs, because of their higher thread angle, require greater end clearance for spur gears and a smaller end clearance for helical gears. Preferred practice is to have the hob thread the same hand as the gear helix. Setting angle of the hob, therefore gets smaller as the hob thread angle gets larger, down to a zero setting angle, when the gear helix and the hob thread angle are equal. Thus, a multiple-thread hob may be used to cut helical gears at a zero setting angle and require end clearance of only little more than half its diameter.

Total hob travel required to complete a gear is also increased by the obliquity of its setting angle. Thus, just as a multiple-thread hob reduces end-clearance requirements in cutting helical gears, it also reduces cutting time. This improvement in operating efficiency will usually be unimportant in relation to other factors to be considered in multiple-thread hobbing, but it can be significant on a narrow-face gear with a high helix angle.

Shaper cutters for helical gears are made and sharpened with the cutting face of each tooth lying normal to the helix angle. The resulting difference in axial position between the opposite sides of the teeth is the end clearance required.

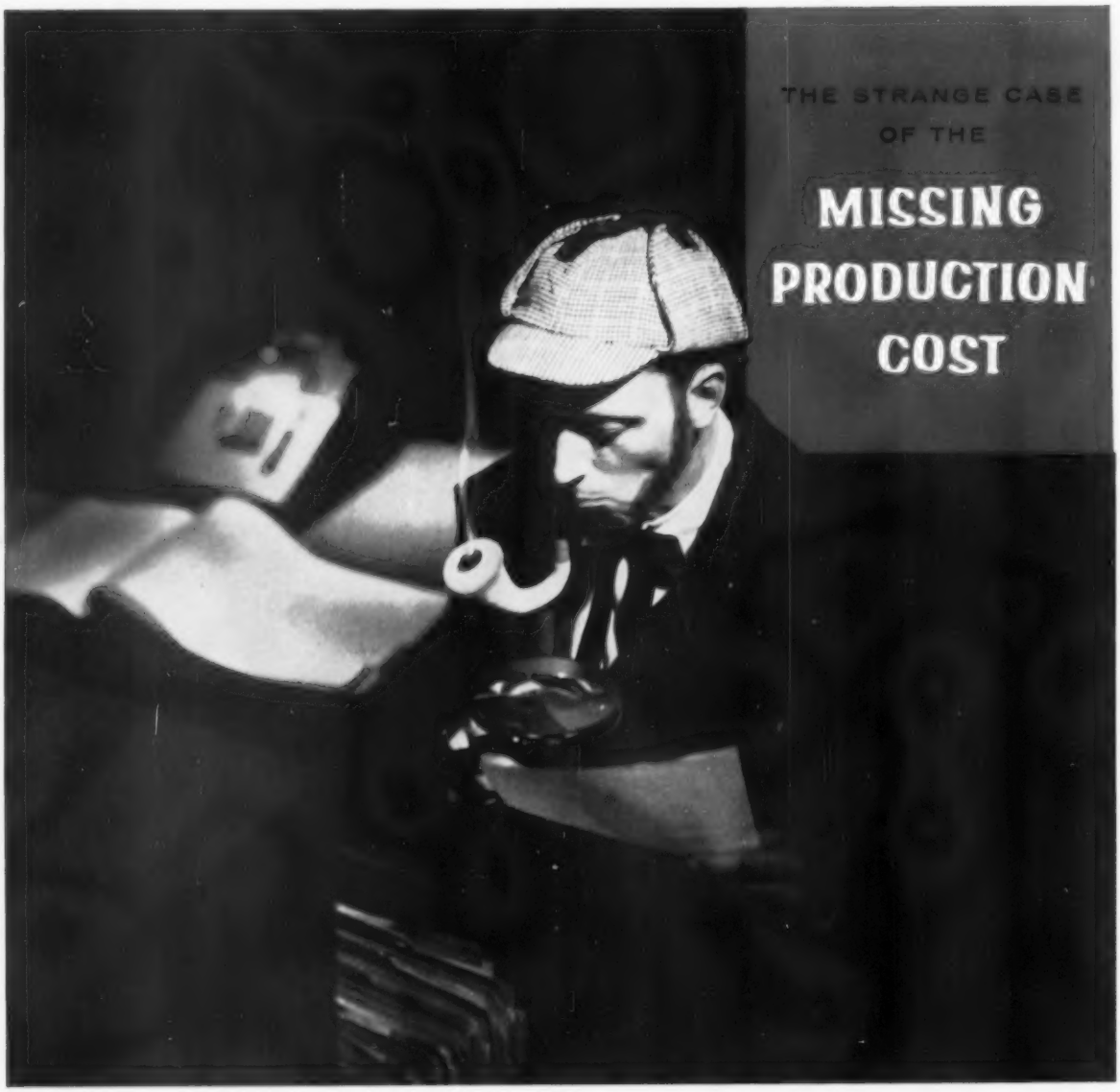
The setup of a gear shaper to cut helical gears requires a helical lead guide and cutter to match. These tooling requirements often make shaping uneconomical.

High helix angles present another obstacle to shaping. Rotation of a shaper cutter in tracing a helical path takes an increasing proportion of the cutter spindle force as the helix angle increases. This is one reason why shaping is not commonly employed on helix angles over 45°.

INTERNAL GEARS

Internal gears are usually cut by shaping or broaching. Shaping is restricted by minimum sizes, and broaches have maximum size limitations.

For broaching, the gear must be open on both sides to the full depth of tooth form to allow passage of the tool. For shaping, the entering side must likewise be open, at least far enough to permit withdrawing the cutter from the gear while remaining at full depth of



ONCE upon a time there was an accounting department that was used to heavy costs to replace worn-out production tools. One month, when they were checking out their figures and preparing cost analyses, part of this cost was missing. Of course this bothered the accounting department because the treasurer of the company needed this cost so he could growl at salesmen when they turned in their expense accounts. They started a systematic check—the kind that only accountants can dream up, and found that the production department had started making a lot of parts out of Copperweld Leaded Alloys—the steels with "built-in productivity." Because of its extreme machinability, they were enjoying not only faster feeds and speeds and high production savings but production tools were lasting much longer—in some cases as much as 10 times as long. The story has a happy ending because everybody was delighted with lower production costs—even the treasurer. He hasn't snarled at a salesman's expense account in months.

ARISTOLOY STEELS

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EXPORT: Copperweld Steel International Co., 225 Broadway, New York 7, N.Y.

For further details on Copperweld Leaded Alloys, write for free booklet, "Lead Treated Steels."

GEAR TOOLING . . III

cut. The other side may be "blind" except for a recess to provide chip clearance.

The minimum diameter that can be shaped depends upon the minimum practical size of cutter and the smallest workable difference in size between cutter and work. Table 1 shows these limitations, based on numbers of teeth and covering the common pressure angles and depth systems. Internal gears smaller than indicated in this table can sometimes be shaped with a cutter of special design. Seldom is it practical, however, to use a shaper cutter of less than 10 teeth.

SHOULDER AND CLUSTER GEARS

External shoulder- or cluster-type gears must be shaped when clearance at either end of the teeth is insufficient to permit a milling cutter, or hob, of smallest feasible diameter, to remain at full depth at the end of the cut. This ability of the shaping process to produce gears with very little tool-travel clearance on one side is an important advantage in many applications. Gears may sometimes be cut integral with parts to which they were formerly assembled. In some cases units may be redesigned more compactly to offer significant space and weight savings. For shaping it is necessary only to provide chip clearance at the end of the cut. In practice, somewhat more than minimum clearance is desirable to allow for machine stroke adjustment. This will vary with pitch. The recommended minimum clearance gap ranges from 1/16 in. on the finer pitches to ¼ in. on the coarser ones.

table 1 . . SIZE GUIDE FOR CUTTERS FOR INTERNAL GEARS

ALL VALUES IN NUMBERS OF TEETH. In addition to table requirements cutter size should not exceed pinion size.

INTERNAL GEAR	20° Stub			20° Full Depth			25° Full Depth		
	Max for Cutter	Max in Pinion	Min for Cutter	Max for Cutter	Max in Pinion	Min for Cutter	Max for Cutter	Max in Pinion	Min for Cutter
22	10	14	10				10	16	10
24	11	16	11	10	14	10	11	18	10
26	12	18	11	10	16	10	12	20	10
28	13	20	12	11	18	11	13	22	11
30	14	22	13	12	20	12	14	24	11
32	16	24	14	14	22	13	16	26	12
36	19	28	16	16	26	15	19	30	13
40	22	32	18	19	30	16	22	34	14
44	25	36	19	22	34	18	25	38	15
48	28	40	21	25	38	20	28	42	16
52	32	44	22	28	42	21	32	46	17
60	38	52	24	35	50	23	38	54	18
70	47	62	26	43	60	26	47	64	19
80	56	72	28	51	70	28	56	74	20

MINIMUM SPAN OF TEETH BETWEEN INTERNAL GEAR AND PINION	20° Stub	20° Full Depth	25° Full Depth
To avoid fouling	8	10	6
For radial assembly	15	18	12

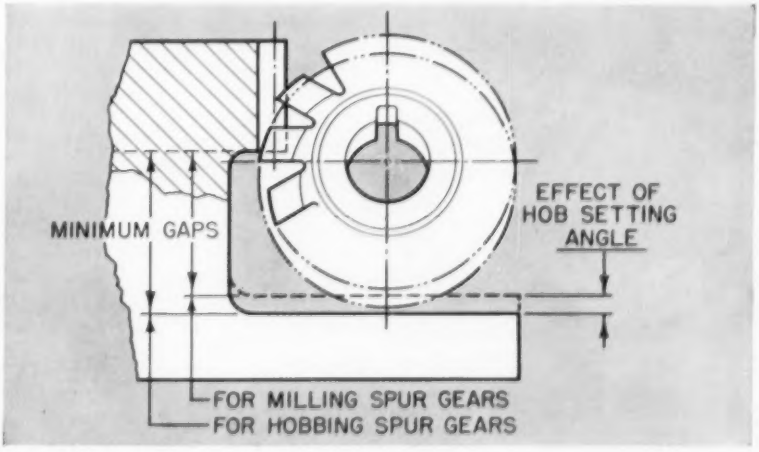

FIG. 5 . . Gap clearance for hobbing or milling

To be continued in an early number.

Do you really know the alloys you buy?

For instance, are you SURE of:

- **Heat identification** . . . not just type identification but the positive identification of your particular heat so you can be sure the alloy steel is everything it is supposed to be?
- **Chemical analysis** . . . not just the chemical range for the type, but the specific analysis of the heat from which your steel was rolled?
- **Hardenability** . . . not just the average hardenability for the type of alloy, but the actual test-proved hardenability of your particular heat of steel?

If you don't know these important facts, you may be in for trouble—loss of time and money; breakdown of equipment. It can happen when you're not sure of your alloys.

But when you work with Ryerson alloys you *can* be sure—sure of the steel you get, sure of what it will do—because Ryerson alloys are certified by an 8-step quality control program.

Every step has a specific purpose—every step is designed for your protection, but doesn't cost you a dime. For alloys with all questions answered, call your nearby Ryerson plant.

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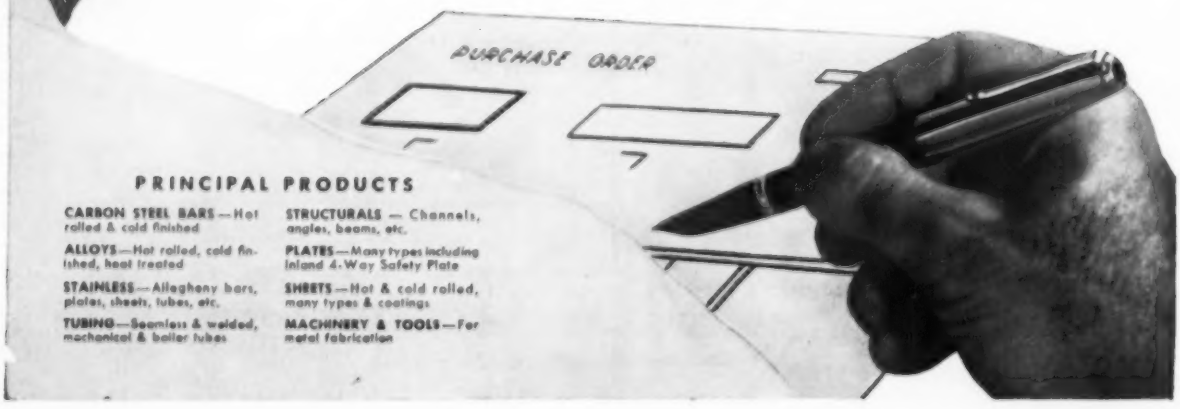

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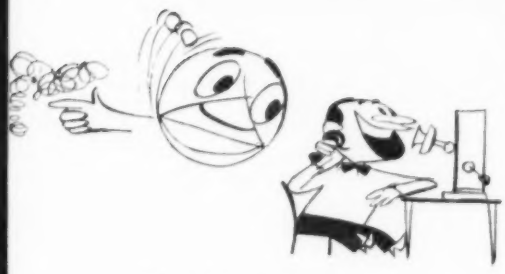
STRUCTURALS — Channels, angles, beams, etc.

PLATES—Many types including Inland 4-Way Safety Plate

SHEETS—Hot & cold rolled, many types & coatings

MACHINERY & TOOLS—For metal fabrication

Talking Shop . . .



Gong Ignored

AT THE OPENING in North Wales, Penna, of Leeds & Northrup's new plant to produce industrial instruments, we heard the story behind the story behind the temperature recorder for generators. The first of these stories tells how Leeds had trouble selling the first indicating recorders to the power industry because "reading temperatures gives the man who has to be there anyway something to do." Then one cold night the water spray froze in the air intake of a generator while the station attendant was chatting on the telephone. By the time he smelled smoke, the damage was done. As this story went the rounds, signalling recorders began to sell more or less like hot cakes.

Now for the story behind this story behind: Turns out that this incident really occurred at one of the few stations that had one of the new-fangled recorders. The operator heard the warning gong, but didn't believe it and continued his phone conversation. He received a vacation without pay, the other story went the rounds, and the gong is (fortunately) not ignored today.

Federalese

CONSULTANT: an ordinary guy 50 miles from home . . . TO ACTIVATE: more carbons and more names on the memo . . . IMPLEMENT A PROGRAM: add men and expand the office . . . WILL ADVISE YOU IN DUE COURSE: if we figure it out, we'll let you know.

Why Worry?

A RECENT CHECK on what individuals worry about disclosed that 43% worried about finances and wages, 30% personal problems, 24% health. World problems, war, atomic bombing? Only 8% worried about those, and mostly for fear of being drafted or having a son drafted.

1-1 in the Ninth

SUCCESS with any improvement in equipment will depend largely on how the change is sold to the workers. A case in point is the experience of two plants with radio control for fork trucks. The plants are in similar locations, make similar products. One has continual difficulty with maintenance, the other has none. In the first case, the dispatcher uses the radios to police the drivers, pushing them to work faster, cursing them for loafing. In this plant, loads are dropped on the radios and soft drinks spilled into them with surprising frequency. In the second plant, the dispatcher not only handles the dispatching by radio, but gives ball scores (in season), weather reports, and other useful but non-essential information. You should see the way drivers nurse those radios.

Three German Ideas

A GERMAN FIRM has developed a new method of drying metal parts rapidly and without staining. Parts are immersed in boiling perchlorethylene with 0.1% by weight of a special additive to reduce adherence of water to metal and speed heat transfer. There is no tendency to form an emulsion and impurities are removed with the water . . . Another German idea is a welding unit cycled by heat impulse or heat of the weld area, rather than by time . . . Another idea is a lathe with adjustable headstock and tailstock so swing over the cross-slide can be increased 85%. From incomplete data we have, it sounds as if the adjustment is made at an angle—the head by servo, the tail by screw—so the resultant of the cutting forces is still on the front guideway.

Spectroheliometer

OUR TITLE is the name for a gadget used by GM Research that tracks the sun, recording the amount and intensity of certain parts of the sun's light which weather paints, lacquers and enamels. The "sun sleuth" is at Miami, has tracked and recorded data on graph paper. Miami beats Detroit, incidentally, by 5 to 1 on sunshine intensity, also doesn't have the so-called "solar twinkle" caused by invisible puffs of smoke in the atmosphere. The gadget enables accurate study of both sun-exposed panels and comparable panels under artificial sunlight from a 1200-watt high-pressure mercury-vapor lamp. Worst sun "beating" occurs—in the Miami area at least—in spring and fall—not summer. The instrument, incidentally, follows the sun as a telescope follows the stars. Light picked up goes through a spectograph, and resulting color bands cause electrical signals that are amplified and recorded.

Standard Measure?

IN THE VAST MAJORITY of accounting "systems," the dollar is the recognized standard of measurement. Yet a number of accounting specialists, and some corporation lawyers, tell us that in almost every bankruptcy, cost records showed the company in the "black" when the real value was deep in the *red*. On the surface, the dollar may appear a very accurate standard, particularly to those of us whose initial education was acquired in the days of the gold standard. This is sheer fantasy.

If the gage blocks used in determining the quality, accuracy, and fit of a product were ten times as accurate as the dollar, as a standard of measurement, the user couldn't stay in business. Nevertheless, this standard dollar is the official device for measuring gross national product, individual business capability, the solvency of individuals and their families, the "fit" of a company in our national economy, financial "interchangeability"—and taxation.

Because your dollars aren't standard, because the long-term trend of value is down, make it your business to review true values from time to time—especially on long-term contracts and depreciation. Don't measure with a standard that may scrap your business!

News of Metalworking . . .

Congress's Wet Firecracker: the Much

WASHINGTON—The Congressional probe into aircraft industry profits has turned out to be a dud. After a detailed staff investigation and weeks of open hearings on procurement costs, production, and profits of at least 12 major military airframe producers, the House Armed Services Investigating Subcommittee has come out with its report. The report's conclusion: "There has been no showing that, on the average, the profits allowed are excessive."

The investigation was started after House Democrats—notably Rep George Mahon of Texas, chairman of the House Military Appropriations Committee—charged last year that profits on military aircraft contracts have been excessive—to say the least.

The Subcommittee, headed by Rep F Edward Hebert (D, La), says that on contracts studied by the investigators, "it may appear that the profits claimed are higher than they ought to be." But since many of the contracts are "incentive type," subject to price redetermination, the Subcommittee says the profits will be revised after final deliveries are made.

From its findings, the Committee reports that the profit "target" for Air Force contractors "appears" to be between 8% and slightly over 9% of sales, and for Navy aircraft contractors from 7 to 10%, both subject to readjustment—either through contract provisions on price redetermination or through Renegotiation Board determinations.

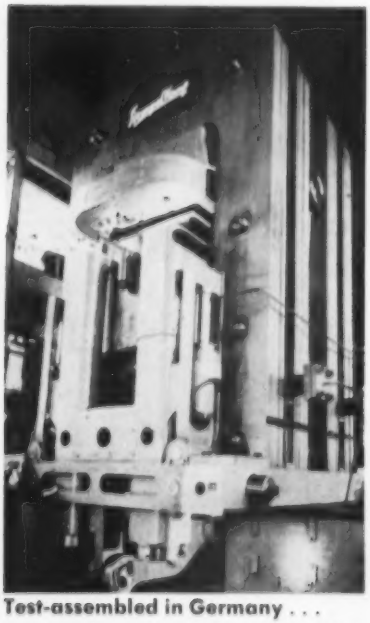
During the investigation, Fairchild Engine & Airplane Corp charged that it had to pay for equipment to replace worn-out machine tools owned by the Air Force. The charge prompted Hebert to say his investigation will include a look into Defense Dept tool replacement policies.

But while the report discusses the use of government-owned tools and plants, it fails to make specific proposals on tool replacement.

The report reveals that total government plant and equipment holdings used by 12 major airframe makers are valued at $895.8 million.

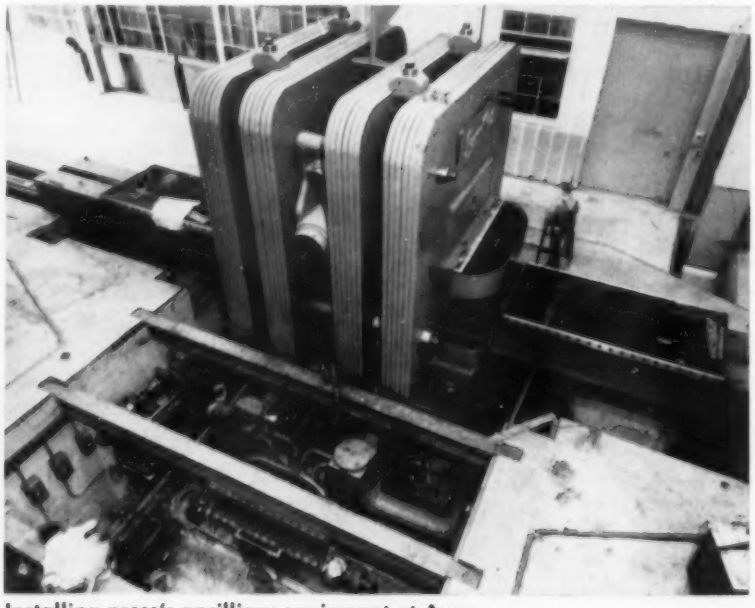
German-Built Hydraulic Rubber-Pad

TORONTO—What is believed to be the world's largest hydraulic rubber-pad forming press is turning out parts for Canada's Avro CF-105 supersonic delta-wing, twin-jet fighter here. Built in West Germany by Siempelkamp, the press took two years to design, manufacture and install, required 600 tons of components and equipment to produce an operating pressure of 15,000 tons. The press can make a complete cycle in 1 minute. Press's unusual feature is exertion of pressure from below, forcing the loading table up onto the rubber pad. The frame is made up of metal wafers in groups of six, with each wafer weighing 10



Test-assembled in Germany . . .

press is shown here before dismantling and shipment to Avro Aircraft Ltd's Malton, Ont, plant



Installing press's ancilliary equipment at Avro . . .

The two loading tables are already in position. One on each side of the press, they're hydraulically operated, have high-speed and cushion slowdown for both directions. This is the first press with a hydraulic packing-change device

Ballyhooed Aircraft Profits Probe

Douglas, using $167.8 million worth of facilities; Boeing, $150 million; Convair, $147 million; and Lockheed, $102.3 million, top the list. These are undepreciated values. The 12 companies' total plant and equipment investment—also undepreciated—comes to $394.6 million. Largest private investments are by Lockheed, Douglas, Boeing, and North American.

The subcommittee suggests that rental charges on government plant and equipment should be "abandoned," that the Defense Dept take its return in "reduced costs of the airframes produced."

Right now, there's no uniform policy on rental payments for military-owned facilities used in defense production. In some instances, contractors pay rental fees—which are later included as operating costs; in others, no rental is collected.

Says the committee: "The result is a distorted financial relationship between companies and the government . . . there is an obvious advantage in company ability to operate with limited capital since plant investment is furnished by the government . . . the addition of rental only serves to inflate operating expenses and the return to management on operating costs." Other findings:

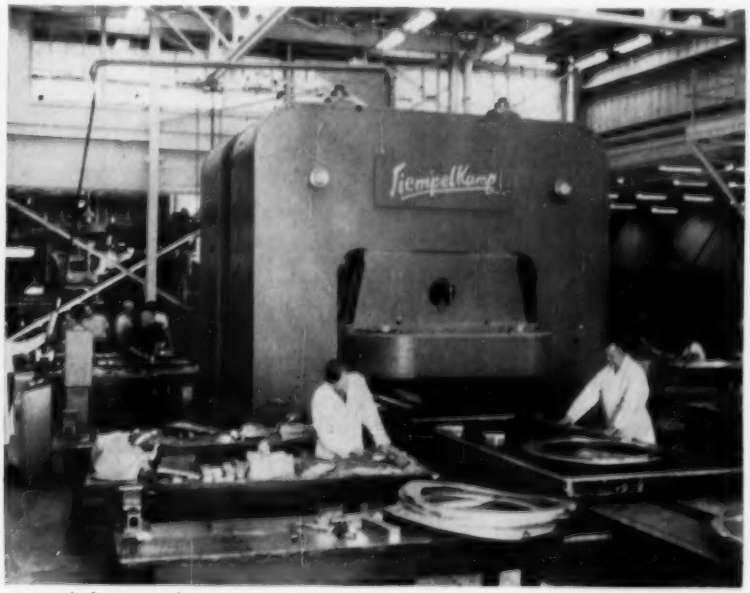
- The military services should charge a rental for non-defense use of government-owned production facilities. This problem arises in so-called "scrambled" facilities—where both private and government-owned equipment are installed, and where both commercial and defense goods are produced.
- Contractors willing to buy scrambled facilities outright for commercial use should get preference. Now, such facilities, when declared surplus, are offered on open bids.
- The Renegotiation Board should set "more certain" ground rules on earnings and profits—to give contractors a "degree of assurance" on their financial status.
- Distribution of dividends from profits by the 12 airframe makers has been "conservative."

Press Forms Jet Parts for Canada's Avro

tons. About 20 ft of the press is below floor level: foundations go down 38 ft. The rubber pad measures 10 x 5 ft, weighs 3686 lb, was made by Goodyear Tire & Rubber of Canada. Main cylinder operates vertically. Large oil tank under continuous 30-lb pressure permits fast advance speed, and four pullback cylinders on the side of the main cylinder make the fast return stroke. A hydraulic equalizing device allows any eccentric load on table, even at maximum pressure. The 600-ton (weight) press achieves 15,000 tons pressure, has a 19-in. stroke, oil pressure of 5700 psi, pad pressure of 4000 psi.

Rubber pad is lowered . . .

onto one of the worktables, which carries it under press, lifts it into position, where suction holds it



. . . and she's ready to go

Workmen load forms and metal sheets on one of the two worktables. Operator at left presses button that slides the table under press. Another button push raises table up into 1-ft-thick rubber pad under 15,000 tons pressure

Tax Cuts for Do-It-Yourself Research

WASHINGTON — The government proposes to liberalize tax deductions for firms that do their own research. In line with this liberalization, which is an offshoot of deductions granted by Congress in 1954 for research and experimental spending in a revision of the Internal Revenue Code, the Internal Revenue Service is circulating the revised and liberalized regulation for industry comment.

Up to now, any such deductions worked out mostly in favor of the larger companies with relatively large year-in-and-year-out research and development programs, and who had the legal and accounting talent to press their case with the Internal Revenue Service. Now, under the new law, smaller and less-well-staffed companies will get the same break as their bigger competitors.

For the first time, deductions for research and development are part and parcel of the new tax code. Before, the Internal Revenue Service used its administrative leeway to grant or not grant more liberal tax terms.

Under the new setup, the old IRS rule of thumb method will be dropped and companies will be allowed to apply the more liberal rules retroactively to research costs incurred in the period December 31, 1953, to August 16, 1954.

Sharper Definitions

The proposed regulation fills a big gap left by the Congressional tax writers—inadequate definition as to what constitutes a deductible expenditure for "research and experimentation."

Here's how the new IRS regulation draws the line between them:

"The term 'research and experimental expenditures' means expenditures incurred in connection with a taxpayer's trade or business which are not deductible under any other provision of the Internal Revenue Laws (e.g., depletion allowed extraction industries), and which represent research and development costs in the experimental or laboratory sense."

Included within this definition are "generally all such costs incident to the development of an experimental or pilot model, a plant process, a product, a formula, an invention, or similar property, and the improvement of already existing property of the type mentioned."

A firm may deduct such costs whether it does its own research or farms out the work to someone else —but farmed-out work cannot be deducted unless "in general" it is of a type that the company could deduct if it handled the job itself.

The "someone else" in this case must be an individual, a research institute, foundation, engineering company, or similar contractor—a rival manufacturer.

Under the proposed rule, a firm can also deduct depreciation or depletion allowances on land or other property it buys or improves for use on a research project—it can't deduct the money it spends to buy or improve the property.

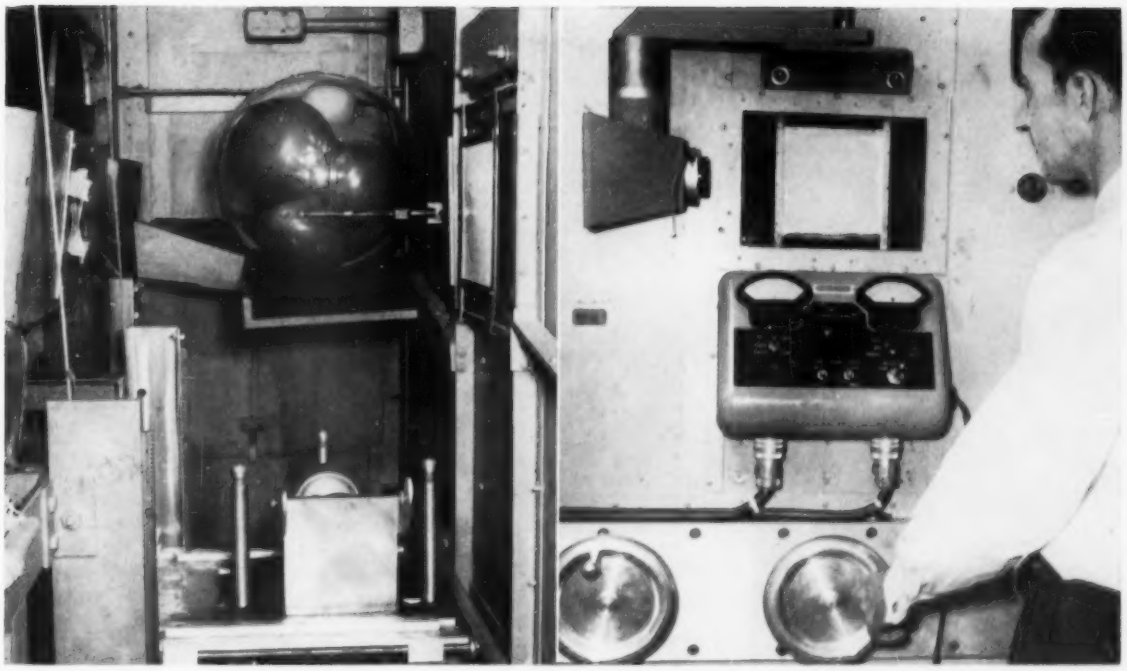
Not eligible as a research expenditure (and not deductible under Section 174) is money spent for quality control, testing or inspection of materials or products, efficiency, marketing or management surveys, advertising and patent costs.

These are the alternative methods of taking the deduction, under the 1954 code: (1) as a current expense for the tax year when the money is actually laid out, or (2) as a deferred expense, permitting the taxpayer to take the deduction over a period of at least five years, starting when the research results begin to yield income. The regulation explains the conditions under which a taxpayer may elect such alternatives.

The Internal Revenue Service kept the proposed regulation open until July 20 for written exceptions, and is expected to hold public hearings before it issues the final rules.

Biggest and smallest circular cutters for machining honeycomb parts . . .

for the SM-62 Snark intercontinental missile are examined by a technician at Northrop Aircraft, Hawthorne, Calif. Cutters vary in size from ¾ to 6 in. dia. Deviations from the circular cutter are shown on the workbench at lower left. Cutter at left has three V-shaped serrations: on the right is a cutter with two chip breakers—for extremely deep cuts. Cutters vary in size depending on depth of cut, and to achieve ideal speed of cut without burning the aluminum honeycomb. All are ground with a 1 to 2 degree bottom concave clearance angle, vary in top clearance 10-30 degrees. Speed of cut varies from 10,250 to 35,000 rpm



Balloons hold test castings secure . . . in plastic bubble for examination on 8-in. fluoroscopic screen (at right) by x-ray (opposite, at left). Platform holding plastic bubble can be raised and lowered, or turned in any direction to allow examination from any angle

Two cranks rotate the plastic bubble . . . to bring all angles of the casting into view on the fluoroscopic screen (center). Swiveling camera (upper left) photographs screen if desired

Bubbles, BuAer and Balloons

. . . they add up to a new fluoroscopic detection method

DALLAS—Plastic bubbles and children's toy balloons are a vital part of the tooling for a new method of high-intensity fluoroscopic testing of aircraft castings that is in the experimental stage at Chance Vought Aircraft here.

Production Evaluation

Developed by Naval Ordnance for the Bureau of Aeronautics (BuAer), the fluoroscope is being evaluated by Chance Vought on a production basis to determine the accuracy of detection, rate of inspection, and general aircraft usefulness. As performed by Chance Vought, the fluoroscope test works this way:

Small castings are placed in plastic bubbles, or globes, and held in place by a cushion of small rubber balloons—the same as those children play with. The sealed globe is positioned between the fluoroscope's X-ray tube and an 8-in. viewing screen. Operator rotates handles outside booth, that in turn rotate the plastic bubble inside the shielded booth so the castings can be inspected from any angle.

Chance Vought, at BuAer's request, will inspect some 2000 castings, large and small, of steel and magnesium during the three-month test period. All castings have previously been inspected by the conventional X-ray method, but the operator is not informed of the flaws revealed by the X-ray method. He maintains detailed records of his fluoroscopic tests—to be compared with the X-ray results. To date, some 600 castings have been inspected by the new method.

Operating reports show speed of inspection, operator darkroom adaptability, operator fatigue, and accuracy of fluoroscopic flaw detection as checked against the X-ray findings. Operator looks for cracks, porosity, voids and other defects that fail to meet Chance Vought aircraft standards. The machine will be tried out on switches, vacuum tubes, fusion weldments, relays and other aircraft parts.

Form Cost Engineering Association

DURHAM, N H—Some 61 engineers from the United States and Canada met here recently on the University of New Hampshire campus to form the American Association of Cost Engineers. Elected first president of the Association is Norman G Bach, supervisor of engineering services, Monsanto Chemical Co, Texas City, Texas. AACE's Honorary First President is Professor O T Zimmerman of the U of New Hampshire.

Purpose of the new Association is to "advance the science and art of cost engineering in or related to the process industries." Interested professionals may join the Association as charter members by September 1 by writing John T Husted, P O Box 1411, Trona, Calif.

Field Report USA:

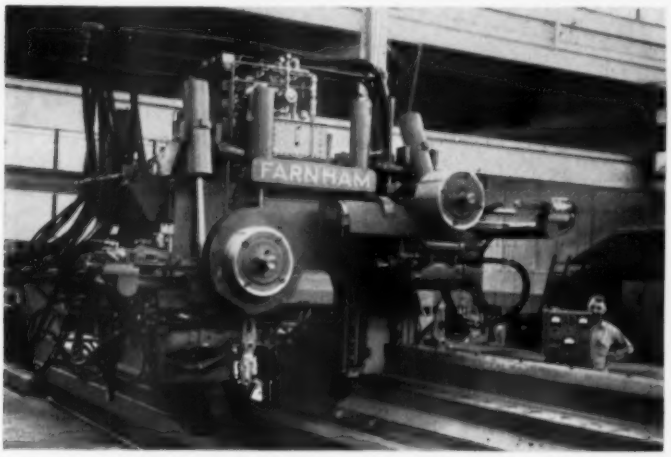
BETHLEHEM, PA: One of the biggest alloy steel hydraulic cylinders ever produced, this Bethlehem Steel-built cylinder is 17 ft long, has maximum OD of 9 ft, was forged from a 552,000-lb, 108-in. dia ingot

CLEVELAND: This isn't a gun barrel—it's a 9-ft, 6-in. pivot shaft for a huge earthmover. It was machined on an air-gage tracer Monarch 16-in. lathe by Midwest Machine & Tool Co to accuracy within 0.002 in.

East...

Eastern newsbriefs . . .

GM's New Departure Division, Bristol, Conn, celebrates its 50th year of precision ball bearing manufacture next month . . . **New York Air Brake Co** has acquired **Optical Film Engineering Co,** Philadelphia maker of high-vacuum systems, will make it its Vacuum Equipment Division . . . **Piasecki Aircraft Corp,** Philadelphia, is currently working on 11 prime contracts for the armed services, expects to get several more soon . . . **Philadelphia Naval Shipyard** will build two guided missile frigates at a cost of around $53 million each. And PNS will also convert two obsolete ships into radar picket escort vessels, two into ocean radar station ships, and another into a seaplane tender . . . **Sharon Steel Corp,** Sharon, Pa, plans to build a $6-million electric furnace shop at its Roemer Works, doubling Sharon's output of stainless and high alloy steels . . . **Arwood Precision Casting Corp,** New York, is branching out into finish-machining of castings for metal-working firms and foundries . . . **Van Norman Industries Inc** is acquiring control of the common stock of **American Pulley Co,** maker of material handling and power transmission equipment . . . **Allegheny Ludlum Steel Corp,** Pittsburgh, has bought out **Paul R Repath Inc,** Los Angeles maker of steel laminations, stampings, and deep-drawn transformer cans . . . **Stevens Institute,** Hoboken, N J, will offer evening courses in materials handling and industrial packaging, starting September 24. Admission qualification is a high school diploma or equivalent experience . . . **H K Porter Co Inc** has purchased **Electric Service Mfg Co,** Philadelphia manufacturer of electric utility equipment . . . **Dresser Mfg Division of Dresser Industries** will build a multi-million-dollar coupling and pipe fittings plant at Wellsboro, Pa. It'll have 100,000 sq ft of floor space, will employ 200 to 300 people . . . That famous "now it's sold, now it's not" war surplus plant at New Castle, Pa, has finally been sold after much haggling back and forth to **Mesta Machine Co** by the government . . . **Standard Pressed Steel Co** has announced a long-range expansion program that includes a $5-million plant in Santa Ana, Calif; and new construction and improvements to its Jenkintown, Pa, plant and its British subsidiary . . . **Birdsboro Steel Foundry & Machine Co,** Birdsboro, Pa, is going into the extrusion press building field with an order for four of them from **Kaiser Aluminum & Chemical Corp's** Halethorpe, Md, plant. All four of them will be delivered by late fall . . . **Industrial Retaining Ring Co** has moved from Mt Vernon, NY, to 57 Cordier St, Irvington, N J . . . **American Car & Foundry Division of ACF Industries,** Philadelphia, has an $8-million Ordnance contract to make 8-in. shells by the hot-cup, cold-draw method . . . **E W Bliss Co** has acquired **John Robertson Co Inc,** Brooklyn maker of lead extrusion presses, will make it a subsidiary . . . **Worcester Pressed Steel Corp,** Worcester, Mass, has a new contract from the Navy to make 250,000 one-piece cylinders for inflating life jackets . . . **American Bosch Arma Corp,** Garden City, N Y, and **Thompson Products Inc,** Cleveland, have worked out a licensing agreement to develop, promote and "subsequently manufacture" an automotive fuel injection system. They figure that by combining forces they'll cut down on tooling requirements . . . **Kennemetal Inc** has bought a 1200-acre tract near Latrobe, Pa, where it will expand its manufacturing facilities and at the same time decentralize to minimize danger from floods . . . **Stanat Mfg Co,** rolling mill equipment maker, is building a 60,000-sq-ft plant at Westbury, L I . . . **Bendix Aviation Corp's**



BUFFALO: Weiner-Rapp Co's Farnham Mfg Division has finished tests on the first of 30 AIA spar milling machines for the Air Force. Machines have infinitely variable carriage speeds from 0 to 300 ipm, four 100-hp milling heads with independent tracing control, can machine 1600 cu in. of aluminum alloy per min, takes parts 3 ft wide, 60 ft long

MILFORD, MICH: This huge automotive jigsaw puzzle is made up of parts from torn-down cars that have just been through a 25,000-mile test at GM's Proving Ground. They'll be inspected and reassembled

Radio Division, Baltimore, has a $20-million Air Force contract to make Early Warning radar equipment . . . **Gerotor May Corp,** Baltimore maker of hydraulic equipment, is building a 64,000-sq-ft plant and office building in suburban Owings Mills, Md . . . **Pratt & Whitney Aircraft,** East Hartford, Conn, expects to take on 3000 new employees before year's end to make jet engines.

South . . .

Around the South . . .

Detroit's **Square D Co** plans to build a $3-million electrical equipment plant on a 29-acre site in Lexington, Ky. The 150,000-sq-ft facility will be completed in about a year . . . **Champion Cable Co,** Cleveland, Ohio, is moving all its operations to LaFollette, Tenn, will get production underway there sometime next month . . . **Conetta Tool & Die Co,** Stamford, Conn, is opening up a subsidiary, **Knoxville Tool & Die Co,** in Knoxville to make gages and fixtures for **Yale & Towne's** Lenoir City, Tenn, plant . . . **Fruehauf Trailer Co** is transferring all its aluminum trailer making facilities to its **Fruehauf-Carter Division,** Memphis, doubling the size of that plant . . . Athens, Ga, will get a $25-million **Westinghouse** transformer plant, with first output slated for mid-1958 . . . **Ford** will spend anywhere from $10 million to $17 million in expanding its Atlanta assembly plant . . . **Triangle Aluminum Products Co,** Miami, will double output of aluminum and glass jalousies at its Atlanta plant . . . **Keener Supply Co,** Wheeling, W Va, machine tool distributor, has been dissolved and reborn as the **Keener-Groman Co,** 1309 Main St, Wheeling . . . **Temco Aircraft Corp,** Dallas, will spend $940,000 to improve its Greenville, Texas, plant . . . **American Safety Razor Corp,** Staunton, Va, has acquired Chicago's **Supreme Products Inc,** maker of geared drill chucks, hair clippers, and precision parts . . . **R G LeTourneau Inc,** Longview, Texas, will use steel from its own electric-furnace steel mill to build a $3½-million offshore oil drilling platform for Zapata Off-Shore Co . . . **Wheland Co,** Chattanooga, will build a fully mechanized $3.5-million foundry next to its present Chattanooga plant, also plans to expand its Ordnance Division Plant at Chattanooga . . . Leeds, Ala, is getting two new plants: **A J Garrard & Co,** Melrose Park, Ill, is building a steel strapping plant there, and **Mira-Flex Watch Band Corp** and **I D Watch Case Co** are building a joint plant.

West . . .

Western newsnotes . . .

Brooks & Perkins Inc, Detroit, is opening a West Coast division at 11655 Vanowen St, North Hollywood, Calif, to handle magnesium and titanium engineering programs in connection with guided missile and jet aircraft output . . . **North American Aviation** has a $5-million Air Force contract to build flight test facilities at Palmdale, Calif. The company is also starting work on T2J jet trainers for the Navy . . . **Lockheed** will build a 68,000-sq-ft addition to its Bakersfield, Calif, subassembly plant for work on its turboprop Electra. It'll employ 250 . . . **Utility Appliance Corp,** Los Angeles, is building a 150,000-sq-ft gas and electric water heater plant in New Albany, Miss . . . **Douglas Aircraft** says it has spent $40 million on new facilities since Korea, has approved $34 million more so far this year . . . **On Mark Engineering Co,** which converts Douglas B-26's to executive planes, will move from Glendale, Calif, to a new $1-million plant at Van Nuys soon . . . **Hycon Mfg Co,** Pasadena, has a $1.2-million Air Force contract to make radio trans-

mission equipment, will fill the order at its LaVerne, Calif, plant, scheduled for completion in six months . . . **Ramo-Wooldridge Corp,** Los Angeles, is setting up a 140,000-sq-ft electronics plant at Englewood, Colo . . . **Harvey Aluminum** is now financially set to build a 54,000-ton aluminum reduction plant at The Dalles, Ore . . . **Marchant Calculators Inc** starts construction this month of a $4-million, 500,000-sq-ft plant and office on the Oakland-Berkeley, Calif, city line . . . **Thermo Materials Inc** has been formed in San Francisco to produce high-temp industrial ceramics at Menlo Park. Calif. It's jointly owned by West Coast financiers and **Frenchtown Porcelain Co** of Trenton, N J . . . **Convair-Astronautics** will build the Atlas intercontinental ballistic missile at its new $40-million plant at Montgomery Field, outside San Diego . . . **Sherwin-Williams Co,** the paint people, are moving their Container Division into a new $500,000 plant at San Leandro, Calif . . . **Griffin Wheel Co** is building a $1-million railroad car wheel foundry (cast steel now, not chilled iron) will move all its West Coast facilities in . . . **Lightcraft of California** is building a light fixture plant and warehouse in Los Angeles . . . Detroit's **Ex-Cell-O Corp** is building its first West Coast manufacturing plant on a 15-acre site at Downey, Calif. It'll employ 150 people to make aircraft parts and drill jig bushings.

Midwest...

Midwestern news . . .

Oliver Corp and **J I Case Co** are talking merger. If it goes through, the combine would become a formidable challenger to International Harvester and Allis-Chalmers in the farm equipment field . . . **LeTourneau-Westinghouse,** Peoria, Ill, will spend $9 million on expansion, including a 300,000 sq ft plant addition that will take $6 million of the total . . . **Illinois Tech** will hold its Third Annual Computer Applications Symposium at Chicago's Morrison Hotel October 9-10. This one will deal with medium-sized computers . . . **Ford** is combining its Lincoln and Continental Divisions, putting all its luxury cars in one basket . . . **Detrex Corp,** Detroit, has been renamed **Detrex Chemical Industries Inc** since August 1 . . . **Stewart-Warner Corp's Electronics Division** has taken over **Allen D Cardwell Electronics Products Corp,** Plainville, Conn, maker of facsimile transmission and reception equipment . . . **Allen-Bradley Co,** Milwaukee motor control and resistor maker, has opened an export office in New York . . . **Allis-Chalmers Mfg Co** and **General Electric's Aviation Gas Turbine Division** have a joint Air Force contract for J-79 jet engine assemblies . . . **Ford** has just built an ultramodern carburetor laboratory at Dearborn. It simulates any travel condition . . . **Federal-Mogul-Bower Bearings** and **National Motor Bearing Co Inc** are merging, with National operating as a division . . . **Sparks-Withington Co,** Jackson, Mich, has purchased **Houston** (Texas) **Pipe & Steel Co,** will operate in conjunction with **Flori Co,** St Louis pipe maker bought by S-W earlier this year . . . **National Malleable & Steel Castings Co,** Cleveland, may build a $10-million plant at Superior, Wis, to make steel balls used in grinding taconite . . . **Rockwell Mfg Co** will spend $2 million to build a 180,000-sq-ft valve manufacturing plant at Kearney, Nebraska. It'll be ready to go by mid-1957 . . . **Master Tank & Welding Co,** Dallas, Texas, maker of LPG tanks will build a 15,000-sq-ft plant at Quincy, Ill . . . **AMF's Leland Electric Co Division** is upping prices of its fractional hp motors 7½% . . . **Ford's** proposed 1.5-million-sq-ft Lorain, Ohio, auto and truck assembly plant will employ 2500 people on a one-shift operation, or 4500 on a two-shift operation. Output will be 960 vehicles a day on a two-shift schedule. Plant will cost nearly $30 million, with $20 million of it going for tooling . . . Incidental intelligence: **American Can Co** says output of beer cans will jump 10% this year to 8.25 billion . . . **Borg-Warner Corp's Detroit Gear Division** will become part of its **Long Mfg Co Division,** with operations centered at the DeQuindre plant, Detroit . . . **Motor Products Corp** has sold its across-the-river-from-Detroit plant in Windsor, Ont, to a Toronto syndicate for upwards of $4 million. It'll keep the name **Motor Products Corp of Canada** . . . **Borg-Warner Corp** may take over **Humphryes Mfg Co,** Mansfield, Ohio, producer of plumbing ware . . . **Fuller Mfg Co,** Kalamazoo, Mich, maker of transmissions, will spend $2 million to double the size of its plant—adding 112,000 sq ft.

World Experts Attend Gas Turbine Talks

Some 70 industrialists and government experts from all over the world were recent guests of General Electric Co in Schenectady at what is believed to be the largest industrial lecture series ever held in the U S on the theory, operation and maintenance of gas turbines. Looking over a scale model are, left to right: E R Scott of Canada; A Mackay and Edmund Fajardo of Venezuela; J P Keller, general manager of GE's Gas Turbine Dept; Charles E Columbus of the U S Coast Guard, and J E Terry of the Trans-Arabian Pipe Line Co. Meeting lasted a full week

T S Bonnema (left), vice president, director, and general manager of Oster Manufacturing Co, Cleveland manufacturer of pipe and bolt threading machinery, has been elected president and general manager. He succeeds **Roger Tewksbury**, head of the firm since 1937, now named chairman of the board

Howard A Wheeler, formerly systems engineer for Pratt & Whitney's Cutting Tool & Gage Division, has joined Ray H Morris & Co, West Hartford, Conn, machine service specialists for Brown & Sharpe Manufacturing Co. He will serve as vice president, sales and service, for Connecticut

Names in the News . . .

Earl F Harris, executive vice president of Rodney Hunt Machine Co, Orange, Mass, has been elected president. **Carl C Harris,** former president, has been named chairman of the board.

John D Gordon, sales manager of Progressive Welder Sales Co, Detroit, has been elected vice president and general manager. **Peter D De Leo,** chief electrical engineer, has been appointed engineering consultant.

Chester A Chamberlain has been named assistant to the president of Diebold, Inc, Canton, Ohio. He was previously associated with the E W Bliss Co as secretary and assistant to the president.

John H Benetz, president of Bridge Tool & Die Works, Philadelphia, and **Joseph N Huser,** president and general manager of B & H Specialty Co, Indianapolis contract tool and die firm, have been named members of the US Trade Mission to Berlin. The Mission will function in connection with the German Industries Fair to be held in Berlin from Sept 15-30.

Sidney A Matthews, project engineer for Standard Pressed Steel Co, Jenkintown, Penna, has been appointed machine tool analyst. In this capacity Mr Matthews will evaluate, recommend, and coordinate the purchase, delivery, and installation of all new machine tools purchased by the firm.

James F Beré, general manager of the Hamilton, Ohio, plant of Clearing Machine Corp, a division of US Industries, has been appointed general manager of the Axelson Manufacturing Co, a Los Angeles, Calif, division. **Howard W Carlisle,** formerly assistant sales manager at Clearing, succeeds Mr Beré as general manager.

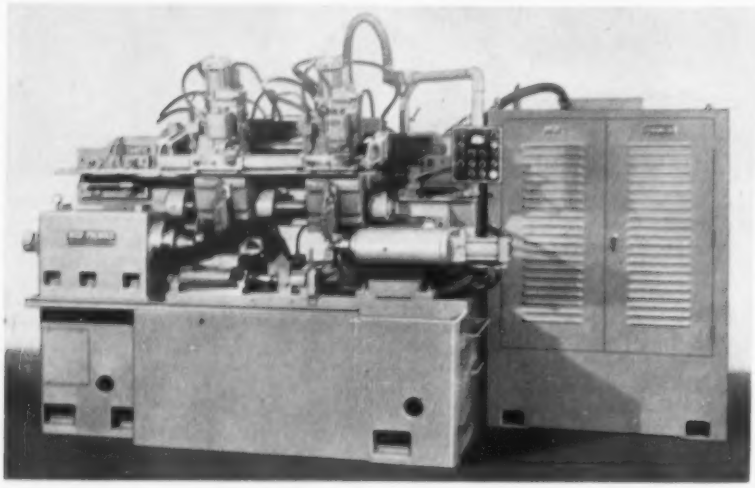
Dr Donald S Clark, professor of mechanical engineering, California Institute of Technology, Pasadena, Calif, has been named 1956-57 president of the American Society for Metals. He is currently serving as vice president. **George M Young,** technical director of The Aluminum Co of Canada, has been named vice president of the Society.

George H Stover, works manager of Chrysler Corp's Dodge Division, has been named manufacturing manager of the Division

Chester S Johns, sales engineer for the Cross Co, Detroit producer of automation machinery, has been named sales manager for standard machines and products

C A Pafenbach has been appointed vice president, sales, for Lavallee & Ide, Chicopee, Mass, manufacturer of precision reamers and drill blanks

New Shop Equipment,



Open-Front Design Gives Easy Access On Reed-Prentice Production Lathes

Known as the Reedmatic, automatic production lathe is available in several sizes and combinations of mechanical feeding or hydraulic tracer slides and can be tooled in a wide variety of arrangements for short-run or high-production turning. Two models are currently offered: C-30 has 18-in. swing over carriage ways and 12-in. over cross-slide ways, with maximum input of 30 hp; Model C-60 swing over carriage ways is 24 in., with 16-in. over cross-slide ways and maximum input of 60 hp. Both models can be arranged for chucking or between-centers work.

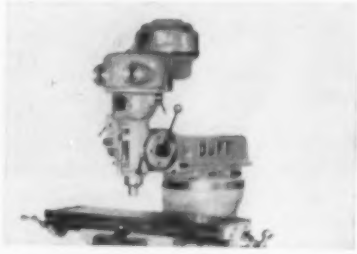
Lathe is designed so that the longitudinal turning slide is mounted on a rigidly constructed top bed, leaving the entire front of the machine open for unobstructed chip drop. Design also facilitates loading and unloading, minimizing operator fatigue and simplifying adaptation to automation. Quadruple pick-off gear arrangement in headstock makes possible a wide range of spindle speed changes. The helical gears are heat-treated, and all gears and pinions are shaved.

With clockwise spindle rotation, thrust of the turning tools is down and toward the top bed; it is likewise downward on the rear slide, eliminating any lifting action on the turning or facing slides and also providing for the elimination of upside-down tools.

When mechanical feed is provided with machine, the slides are motivated by anti-friction, anti-backlash ball screw and nut. If tracer application is employed, carriages are motivated hydraulically and the tracer-and-feed control is used. Tracer, mounted 90° from centerline of spindle, permits mounting of multiple tracing slides to operate independently or simultaneously; slides can feed transversely as well as longitudinally. Thus the machine in a continuous cycle can generate fillets and face shoulders with great accuracy, reducing the stock removal in subsequent grinding operations.

A micro-control provides for fine adjustments for size control without disturbing position of cutting tool and tool holder. Micrometer adjustment is provided for both diameter and lateral size control. A multi-cycle control automatically positions tool slides for any predetermined number of cycles, thus making it possible to rough, semi-finish, and finish work without removing it from the machine. Slides are automatically lubricated.

Reed-Prentice Corp, Worcester 4, Mass



Duff Milling Head Provides Spindle Speeds to 3000 rpm

Milling attachment made for Duff ram-turret vertical miller is designated Model VS-4. The 1-hp attachment has variable spindle speeds from 85 to 3000 rpm. Operator merely engages or disengages back gears and dials speed wanted. Included is three-speed power feed to quill and spindle brake. Attachment rotates 360° around face of ram and 45° in or out across table.

Duff Machine Co, 31 Wingate St, Haverhill, Mass

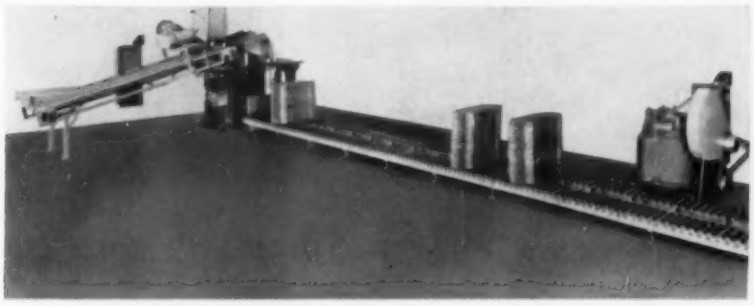
G E Pneumatic Timer for Automatic Control Circuits

Intended for use in automatic control circuits such as those connected with machine-tool sequencing and the operation of cranes and conveyors, heavy-duty pneumatic timer has a time delay of 1/5 to 180 sec, with an accuracy of ±10% of the setting. GE Strongbox coil on the magnet structure sharply reduces coil failure by excluding dirt and moisture, and protects windings from mechanical damage.

All wiring terminals are accessible from front of unit and are mounted on plastic supports. Filtered vertical air intake helps prevent dust from entering time-setting orifice. Operation of timer can be changed from on-delay to off-delay, requires only a screwdriver. Timing element with timing contacts is available independently for mechanical connection to GE Sizes 0 through 4 contactors and also for separate use at user's discretion. Units can be supplied with a maximum of two instantaneous interlocks.

General Electric Co, Schenectady 5, NY

Materials and Parts . . .



Automatic Conveyor System Provides Press-to-Press Materials Handling

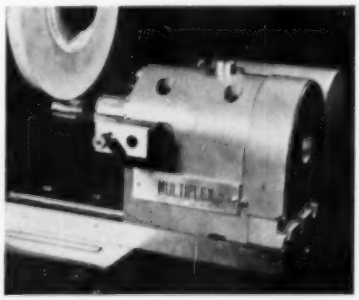
Designed to handle metal blanks automatically between blanking press and secondary-operation presses, materials-handling system conveys, stacks, shuttles, and stores parts. System eliminates need for tote boxes for storing blanks, as well as the necessity for continually handling tote boxes.

In operation, parts from blanking press are first carried by chain conveyor to a stacker. Here the blanks fall between guides in a pre-load position and are held by retractable fingers controlled by air cylinders. Cylinders are held open for 20 sec, allowing 5 to 10 blanks to pre-load. During this pre-load interval, gates open on the stacker, and previously stacked blanks are pushed from stacker onto shuttle conveyor. Operating cycle of stacker is controlled by height of stack, normally between 16 and 18 in., but variable to suit particular needs.

On shuttle conveyor, each stack is shuttled in steps to a position just behind previous stack, where it is stored to await its turn to be fed automatically to the secondary presses. Length of shuttle conveyor can vary to suit specific storage requirements. Shuttle conveyor is operated by motor and reducer mounted beside shuttle bar, which carries the pushers.

In the system, called the Press-to-Press Automat, chain feed conveyor and shuttle conveyor are separately operated, so that downtime on one press never interferes with production on the other press. In addition, the stacker has its own control to assure safety in operation.

Michigan Production Engineering Co, 1796 E 9 Mile Rd, Hazel Park, Mich



Multiplex Indexing Head Adapts To Variety of Operations

Motor-driven rotary head, designed also for manual indexing, is equipped with collets ranging from ¼ to 1 in., and with an interchangeable 4-in. three-jaw chuck. Operable in either horizontal or vertical position, head may be used for a variety of operations, including milling, grinding, and boring. Illustration shows unit extended over chuck by use of auxiliary baseplate for OD and index grinding.

A 24-step plate and stop pin are employed for the index positioning. Motor rotates the spindle at about 250 rpm. Motor and spindle are assembled on a common base.

Multiplex Co, 1536 Getty St, Muskegon, Mich

...including

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Hill Double-End Machines Perform Forming and Machining Operations

Line of high-speed double-end machines designed for either press forming or metal-removing operations on a production basis will handle rods or tubular parts from 1 to 24 ft long. Machines have hydraulically operated automatic magazine feeds and two hydraulically powered, motorized heads that can develop up to 20 tons of thrust force each. Production rates per hour range from 300 to 5000 pieces, depending on part size and operations performed.

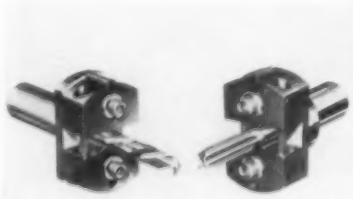
Without the motorized heads turning, parts can be fed through the magazine feed in conjunction with a length-adjustment feature. Thus the machine can be operated like a forming press that will expand, reduce, flare, or bead both ends of the work simultaneously.

With the motorized heads turning, parts can also be fed with the magazine feed in conjunction with the length-adjustment feature. In this arrangement, machines will burr, chamfer, face, spin, drill, ream, or precision-bore both ends of work simultaneously.

Heads are individually controlled and have individual feed and stroke adjustments, enabling different types of operations to be performed at each end of work. Quills in each of the motorized heads have No. 40 milling-machine taper noses. Machine has welded-steel base into which is built 10-to-30-hp, 20-to-70-gpm, 1000-psi hydraulic power units and a centrifugal-pump coolant supply system. All hydraulic components have 2000-psi capacity, and fittings are 20,000-psi capacity. The 4-in.-dia, 6-in.-stroke quills are powered with 5-hp, 4-speed motor drives. Feed of quill is variable up to 30 ipm.

Unit illustrated bores, faces, and chamfers both ID and OD on each end of a 30-in.-long, 2-in.-dia tubular-steel automotive steering column at a rate of 950 pieces per hour.

Walter P Hill, Inc, 22183 Telegraph Rd, Detroit 19, Mich



Sliding Jaws on Toolholders Provide Four-Point Holding

Adjustable toolholders in three versions include a drill holder for automatic and hand screw machines, a non-releasing tap holder for automatics, and a releasing tap holder for hand machines. Holders utilize a pair of independently mounted sliding jaws which provide 4-point holding; jaws move in a vertical direction to accommodate every size tool within the capacity of the machine for which the holder is designed. Horizontal float is provided for accurate centering.

Holders eliminate need for accessories such as bushings and collets. Because drill-holder shanks are hollow, there is no need to cut off tool shanks. Only top jaw is unlocked to remove the tool. Both drill holders and non-releasing tap holders can be used as reamer holders. For extremely close work, special jaws with locking screws recessed flush with outer face of jaws are available in smaller-size holders.

Royel Tools, 4221 Excelsior Blvd, Minneapolis 16, Minn

Pedestal-Model Honing Machine Features Enclosed Coolant Unit

New model JCP honing machine features enclosure of coolant unit in base, 10-gallon capacity, and V-belt drive. Spindle speeds range from 400 to 1000 rpm, and the honing range is from 0.120 to 2.500 in., without adapters. Mandrels, which fit with bayonet lock, or stones can be changed without use of tools.

Other features include adjustable pressure foot-pedal, flexible coolant hose, adjustable flow nozzle, and baked enamel finish.

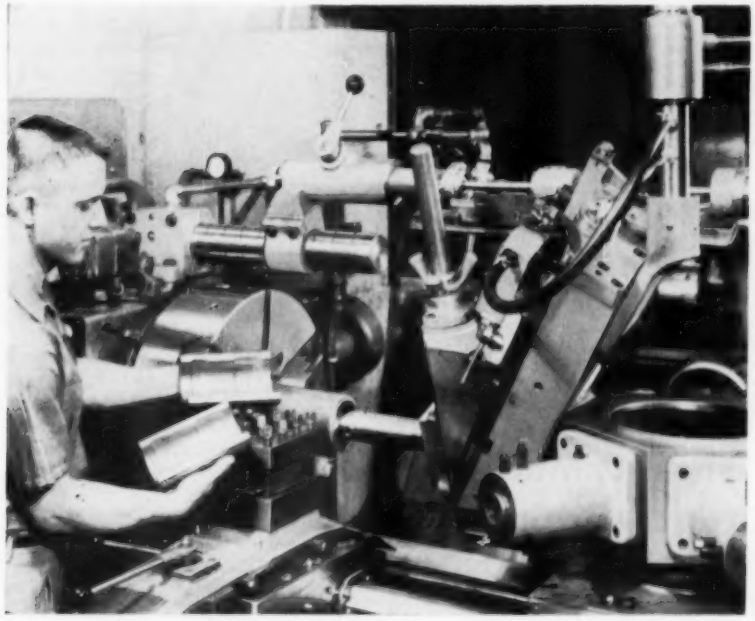
Superior Hone Corp, 1607 Elreno St, Elkhart, Ind

Combination Liquid Chillers Use Air and Water in Tandem

Electric refrigerated units for cooling hydraulic oils and coolants use water only as an auxiliary in excessive high production or hot weather.

When operating under normal conditions air is used to dissipate heat. If pressure exceeds normal on the air-cooled radiator, water enters the system, relieves pressure automatically, shuts off automatically as it decreases.

Lundholm Manufacturing Co, 1121 Charles St, East Rockford, Ill



Warner & Swasey Slide-Tool Attachment Bores Complex Internal Contours

Hydraulically controlled slide-tool attachment, designed for internal contour boring of complex shapes as well as large-diameter contour turning, is engineered for application on company's No. 3-A and 4-A heavy-duty, saddle-type turret lathes. Tool mounts on any face of the hexagon turret at a 60° angle to the spindle centerline. Complete tool, with templet holder and templet attached, indexes with the turret, thus eliminating any interference with other tooling located on adjacent turret faces.

Actuation of the attachment's tracer slide is by means of a large, direct-acting hydraulic cylinder. The long piston stroke of this cylinder provides an effective cutter travel of 4 in., permitting the machining of contours having up to 8-in.-dia variation. Sensitive tracer-slide response is obtained from a differential-pressure, closed-circuit hydraulic system regulated by a stylus-controlled valve. Hydraulic oil for tracer mechanism is supplied by a separate unit at rear of machine.

Tracer's templet holder and templet slide on scraped way integral with slide-tool base. Overhead pilot bar, equipped with micrometer-adjusted bayonet lock, facilitates longitudinal templet positioning. During lathe operation, bayonet lock allows slide tool to be rapid-traversed into lockup position at point selected for start of the contour cut. Following machining, clearing of cutter is accomplished manually by a flip of the cylinder-return lever. Special safety stop block prevents accidental contact between tool and opposite side of work.

Micrometer-adjusted tool-holding block provides precision adjustments over a vertical range of 10¼ in. Company reports that, because regular turret-lathe work may be performed at any time on machines equipped with the attachment, the tool is well-suited for use in shops not requiring full-time tracing facilities.

Tracing action can be controlled in two directions by the addition of a special dual templet. With a special two-cutter bar mounted in the toolholder, an optional setup can be provided which will allow the attachment to contour-bore both "in" and "out." This feature permits completion of all surfaces in a complex bore in one setup.

Warner & Swasey Co, 5701 Carnegie Ave, Cleveland 3, Ohio

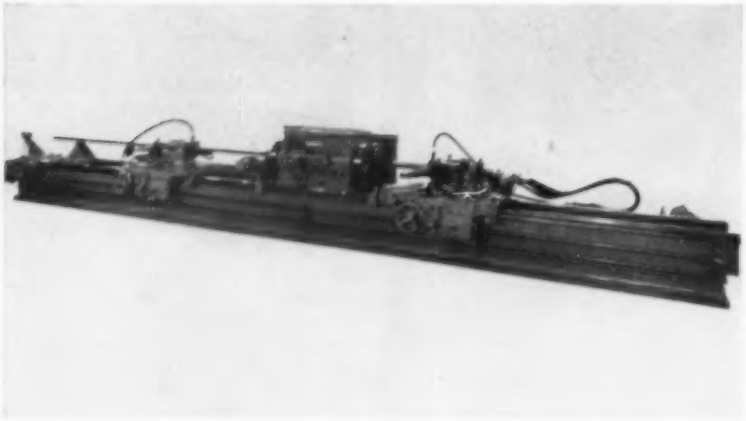
Electronic Guards Offer Power Press Protection

Substantially a wide-area electric eye, electronic device for protecting punchpress operator uses a curtain of light from 4 to 12 in. high. In this curtain there are no gaps, and the slightest intrusion of the hand into the curtain will stop the press. Guard is designed for presses that can be stopped at any point in the operating cycle. A balance lamp incorporated into the device protects the guard from line-voltage variations.

A second electronic guard, for use on power brakes and shears, consists of a light projector and a photoelectric receiver. Projector has a spinning disk which "chops" the light beam into light pulses, and the receiver contains a tiny lead-sulphide photocell which converts these light pulses into electrical pulses, which are fed to an amplifier control remotely mounted. Because the amplifier responds only to these pulses, no other light can affect its operation, and the effect of any circuit failure would be the same as from the interruption of the light beam. Any intrusion between the projector and the receiver causes brake or shear to stop. On power brakes, once dies have met and danger at pinch point has disappeared, device is shorted out, so that work as it bends into the beam will not interfere with the operation. Receiver can be adjusted to individual dies to insure proper placement of beam for specific braking operations.

Electronic Control Corp, 1573 E Forest Ave, Detroit, Mich

BATCH-TYPE CLEANING MACHINE, called Aja-Lif Roll-O-Matic Metal Laundry, automatically washes, rinses, rust-protects, and dries small metal parts. Dirty parts are loaded in a revolving drum attached to an air cylinder, then drum is lowered into tank. Parts are rotated in wash solution, then spray-rinsed, anti-rust-treated, and finally dried by hot air. Washing and anti-rusting solutions can be salvaged for reuse. After completion of final stage, drum is automatically raised—*Magnus Chemical Co, Inc, Dept AM, Equipment Div, Garwood, NJ*



Aircraft Compressor Shaft Is Machined On Giant Lehmann-Brandes Lathe

Special double-end, hollow-spindle lathe is a 32-in. unit designed for profile-boring and facing front compressor shafts for a jet engine in one setting. A one-piece 38-ft bed is provided, with a carriage on both ends of the headstock. On each carriage is a 24-in. hexagon turret mounted on 45° roller-bearing, angular slides, both arranged with independent Turchan followers with indexing templet holders for the several profiles of the various boring bars.

Heavy carriages have a series of spring-loaded rollers supporting the major part of the carriage weight, and both carriages have power rapid traverse and automatic length stops which disengage the apron feed handles.

With universal chucks on both ends of the spindle, machining is accomplished at one setting. Hydraulically operated work support in the center of the spindle, controlled by a handle on front of the headstock, prevents any deflection of work between the two outer chucks.

A liberal flow of high-pressure coolant is provided, carrying chips to a full-length pan at rear of lathe. Control of hydraulic driving clutches and hydraulic brakes is made at either carriage or at the headstock.

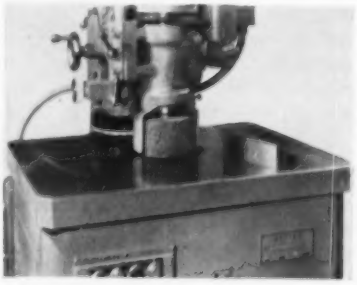
Lehmann-Brandes Machine Co, Chouteau & Grand Blvd, St Louis 3, Mo

Oil-Rite Drop-Feed Oilers Automatically Flush Bearings

Designed to supply a relatively large amount of oil for a short time when starting a bearing, drop and flush oilers automatically flood or flush a bearing with a definite amount of oil at the starting period, after which oil will feed drop by drop. Quantity of oil provided for flushing is fixed, while drop feeding can be adjusted. After oiler is shut off it will automatically reset itself for the next operating period.

Oil is released by gravity from a reservoir. Drop feed can be observed and adjusted within a wide range on sight-feed valve. Units are solenoid-operated; solenoid valve is usually wired across line of the driving motor for automatic operation, but manual units can also be furnished.

Oil-Rite Corp, 2386 Waldo Blvd, Manitowoc, Wis



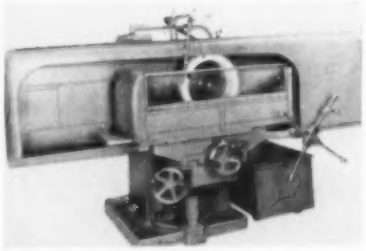
Kindt-Collins Profiler Grinds Large Die Sections

A precision tool made for the fast removal of metal on steel-punch or heavy press die sections, heavy-duty master profiler and contour grinder will grind large die sections to close specifications in a minimum of time. Spindle supported by a heavy column and overarm serves as mounting for grinding wheel, which ranges in size up to 6-in. diameter by 4-in. height. Power is supplied by an enclosed 2-hp motor, remote controlled by pushbutton.

Wheel has ⅜-in. stroke, with 72 oscillations per min (at option of operator, wheel can be non-oscillating). It can be tilted from 0 to 5° by means of a handwheel adjustment and can be raised from table level to 10 in. above. Wheel guard swivels on the spindle quill and locks in any position. A diamond dresser is built into the machine; wheel can be dressed without changing elevation of the head or degree of tilt.

Machine may be connected to a dust-collecting system or separate unit. Heavy 24 x 30-in. cast-iron table stands 37½ in. from floor.

Kindt-Collins Co, 12651 Elmwood Ave, Cleveland 11, Ohio



Redesigned Face Grinder Has Motorized Spindle

18-in. face grinder, with cup-shaped grinding wheel mounted perpendicular to the table, incorporates a motorized spindle. Pulleys and belts are eliminated, and 15-hp, 900-rpm motor furnishes powerful drive.

At 900 rpm, unit faces cold or hot-rolled steel, tool steels, steel castings, and all non-ferrous alloys. Used for grinding castings, it reportedly eliminates all milling or planing and requires less stock to be left on for finishing.

Abrasive Machine Tool Co, East Providence, RI

Pressed Gears Made By Improved Process

Gears are rough formed by pressing powdered metal into dies, submerged in an oil bath, heat treated to specifications, and finish ground. Metal, known as Super-Oilite, is said to retain oil throughout gear life.

Gears are held to tolerances of 0.0005 of an inch and lower, if desired. Standard sizes to 4 in. OD and to 2½ in. in thickness are available.

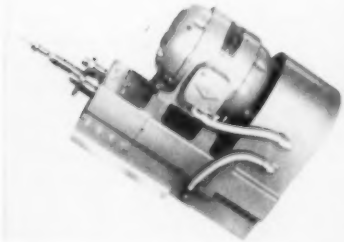
A A Specialty Gear Co, 12527 Edwin Ct, Cleveland 12, Ohio

Powered Squaring Shears Offered in New Line

Pexto power squaring shears feature precision gaging, positive hold-down, and built-in blade clearances. Close setting at the cutting edge is held while proper face clearance between upper and lower blades is developed as shear stroke progresses past the point of cut.

Other features of line include embedded scales; individual plunger, self-compensating hold-down; adjustable finger guard; four-edge alloy-steel blade; T-slot full length in bed; full-skirt safety guard; and fully visible cutting line. Bulletin 57.

Peck, Stow & Wilcox Co, Southington, Conn



Johnson Leadscrew Tapping Unit Operates in Any Position

Precision leadscrew tapping unit measures only 24½ in. in length, 11 in. in width, and 17 in. in height, yet can reportedly drive a ¾-in. tap in cast iron, or a group of taps up to this capacity. Unit has 4-in. spindle travel and can be used in any position.

Built-in electrical relays allow automatic or manual cycling. Each unit is provided with its own control panel and is capable of 30 reversals per min. To avoid tool breakage in the event a tap hits a blind hole, unit has a built-in automatic safety clutch and spring-loaded spindle that automatically protects the tool and at the same time warns the operator and returns the spindle.

Standard unit is provided with a ¾-hp 900-rpm motor, but for special applications a 1- or 1½-hp 1800-rpm motor can be provided. All castings, including the motor housing, are aluminum alloy.

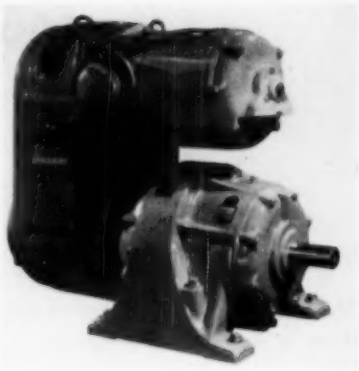
Johnson Drill Head Co, 23rd Ave & 20th St, Rockford, Ill

Hapman Elevator-Conveyor Lifts Free-Flowing Materials

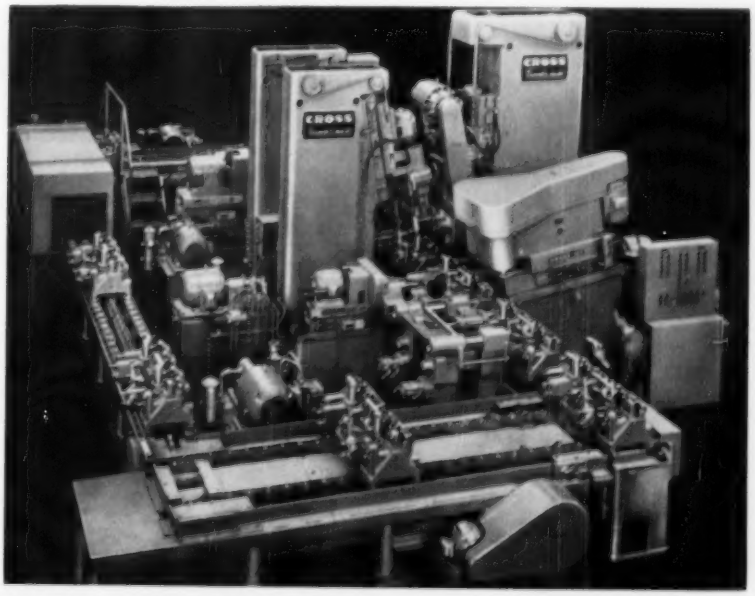
Designed for elevating free-flowing materials such as welding flux and plastic powder, Hi-Lift Cableveyor-Elevator is available with 4-, 8-, or 12-in.-dia tubes. Either center-discharge chute for low speed of 60 fpm or side discharge for high-speed operation up to 250 fpm is offered.

Unit consists of standard steel cable carrying concave stamped or cast metal buckets, uniformly spaced by heavy springs under compression. Flexible connection joins cable ends. There are no rivets, bolts, or other fastenings to wear out, and design permits cable to flex naturally under low stress. Pneumatic rubber-tired drive is provided, together with take-up wheels which eliminate sprockets. Head with variable-speed drive is available. Bulletin HLC-207.

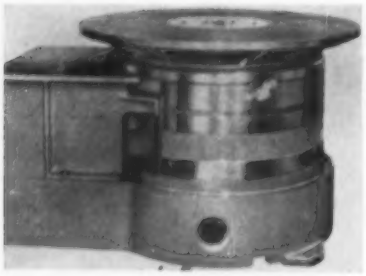
Hapman Conveyors, Inc, Kalamazoo, Mich



VARIABLE-SPEED MOTOR called Varidrive is an internally geared unit with takeoff shaft and motor on the same side, and is said to be suited for low-speed applications where weight distribution and limited space are factors. Types VEV-1-GD (double-reduction) and VEV-1-GM (triple-reduction) are available up through 5 hp. Both upright and horizontal assemblies are offered with drip-proof, totally enclosed, or explosion-proof motors. Units provide very slow speeds and high torque without resorting to separate gear boxes, speed changers, or extra couplings—*U S Electrical Motors, Inc, Box 2058, Terminal Annex, Los Angeles 54, Calif*



AUTOMOTIVE EXHAUST MANIFOLDS are machined on special Transfer-matic machine, which utilizes six stations to perform 51 operations: 8 milling; 37 drilling, chamfering, and spotfacing; and 6 tapping. Unit is composed of standard parts, components, and assemblies. Palletized workholding fixtures for holding one right-hand and one left-hand manifold are automatically operated by hydraulic power wrench. Other features include automatic transfer mechanism, hydraulic feed and rapid traverse, and individual leadscrew feed for tapping—*Cross Co, Detroit, Mich*



Heavy-Duty Indexing Chassis Cuts Cost in Automation Projects

Series H machine is a standard, turret-type unit for heavy-duty applications, suited to automation planning. It is capable of handling turret loads in excess of 3500 lb, yet has an indexing accuracy of ±0.001 in. at 60-in. diameter.

Turret is positioned during work cycles by an independent, positive wedge-locking device, and a cycloidal-type cross-over cam provides smooth operation.

Electric clutch-brake gives infinite cycle variation, and tool mounting surfaces are provided by stationary center plate and by adjustable angle brackets. Turrets are available in diameters from 42 in. to 72 in., with choice of working stations ranging from 6 to 32. Tooling may be interlocked to indexing by customer or through use of available electrical control panel.

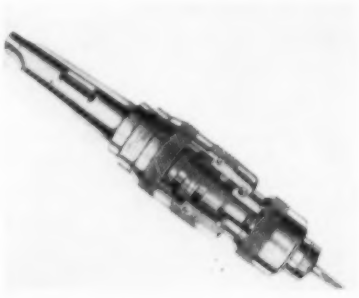
Swanson Tool & Machine Products, Inc, Erie, Pa

Ballymore Hydraulic Work Platform Rises up to 10 Feet

Flexibility and portability are the features of hydraulically operated work platform. In its lowest position, platform is 5 ft above floor level, and hydraulic power raises it to a maximum height of 15 ft. Power can be supplied in any of three ways: by ¼-hp electric motor; self-contained, battery-operated motor; or by hand pump.

Unit is mounted on ball-bearing casters, and has leveling jacks at each corner. Platform, 33 in. x 7 ft 8 in., is made of expanded steel and has a 3-ft guardrail along one side. Rated load is 1250 lb.

Ballymore Co, Wayne, Pa



Davis Tapping Head Regulates Driving Torque Automatically

Adjustable-clutch tapping head known as Tap-Saver regulates driving torque automatically according to hardness of material and type and size of tap, after a dial setting is made. Threads can never be forced when spindle is withdrawn, because it elevates slightly ahead of the tap, so that tap leaves hole by spring retraction.

Head can be used for drilling, reaming, spot-facing, or counterboring, in addition to right or left hand tapping. It is available in three standard sizes to accommodate Morse taper-shank drill collets 2, 3, and 4. Each head is supplied as part of a set which includes 10 collets. Set accommodates tap collet range from ¼ through 2-in. diameter.

Davis Boring Tool Div, Giddings & Lewis Machine Tool Co, Fond du Lac, Wis

HYDRAULIC PRESS BRAKE forms up to seven different angles in succession without operator's resetting controls. Range is from 12-in.-deep bends formed in a single stroke to bends of less than ⅛-in. width, with press cycling at 50 spm or more. Work can be done at any point along length of bed. Piece can be passed progressively from die to die for blanking, deep drawing, embossing, punching, and forming—*Pacific Industrial Mfg Co, 848 49th Ave, Oakland 1, Calif*

Drill blanks intended primarily for the sizing of holes can also be used for punches, knock-out pins, gages, dowels, and rollers, as well as for stock. Blanks are same length as jobbers' drills, hardened and ground to a tolerance of ±0.0003. Blanks ground to tolerance of +0.0002 to −0.0000 are also available at no extra cost. Units may be had in complete range of fractional, letter, and wire-gage sizes.

Whitman & Barnes, 30600 Plymouth Rd, Plymouth, Mich

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MACHINES AND ATTACHMENTS

1 PRODUCTION LATHE—*Reed-Prentice Corp, Worcester 5, Mass.* 8-page catalog describes and illustrates design and construction features of heavy-duty Reedmatic with automatic tracer controls. Spindle speeds of Model C30 are 40 to 1200 and 80 to 2400; Model C-60, 30 to 900 and 60 to 1800; swing over carriage ways is 18 in. for C-30, 24 in. for C-60; feed is 0.005-0.150 ipr.

2 BED TYPE MILL—*Motch & Merryweather Machinery Co, Cleveland 13, Ohio.* 10-page bulletin contains illustrated information on heavy-duty Mill-M-Matics with 84 possible spindle speeds from 25 to 1230 rpm. Features described; detailed specifications given for 8 models.

3 ELECTROLYTIC GRINDING—*Anocut Engineering Co, Chicago 6, Ill.* 4-page bulletin 300 discusses engineering suggestions for modification of standard grinding machinery to Anocut equipment. Outlines procedures for adapting any standard grinder for use with the process.

4 TWIN ROTARY GRINDERS — *Thompson Grinder Co, Springfield, Ohio.* 8-page catalog TR56 describes Type TR circular grinding machines. Applications, features, location of controls illustrated; specifications and floor plan included.

5 DIE-CASTING MACHINE — *Cuyahoga Industries, Cleveland 12, Ohio.* 4-page bulletin contains illustrated description of the Wedgelock unit available in three sizes with max die space of 22, 25, and 32 in.; capacities per shot (lb) 2/3 full, 7, 10.8, and 15. Design features discussed and pictured.

6 GROOVING MACHINES—*Niagara Machine & Tool Works, Buffalo 11, NY.* 4-page illustrated bulletin 76-C covers Model 48-U, a universal power unit with multi-purpose horn for closing both single and Pittsburgh lock seams. Operational details and specifications included.

7 PRESS BRAKES—*Cleveland Crane & Engineering Co, Wickliffe, Ohio.* 8-page catalog 2010-J pictures and describes construction details of Steelweld units. Dimensions and specifications given for entire standard line ranging in bending capacity to 14 ft x ¾ in. mild steel.

8 AUTOMATIC LADLING UNIT FOR ALUMINUM—*Lindberg-Fisher Div, Lindberg Engineering Co, Chicago 12, Ill.* Illustrated bulletin 570 gives technical data for use of equipment for fully automatic processing of many types of castings, especially aluminum die casting and permanent mold. Features, construction, operational principle covered; panel cubicle and controls described.

TOOLS AND ACCESSORIES

9 CARBIDE PRODUCTS — *Allegheny Ludlum Steel Corp, Pittsburgh 22, Penna.* 32-page illustrated "Carmet Catalog" gives detailed data on products including standard, insert, throw-away, and special blanks; standard tools, die sections and punches, die inserts, piercing punches and bushings. Applications included, as well as section of selection of carbide grades.

10 DECIMAL EQUIVALENT CHART —*Dayton Rogers Manufacturing Co, Minneapolis 7, Minn.* Combination chart and calendar is available, dated from July 1956 through June 1957.

11 COLLAPSIBLE TAPS—*Landis Machine Co, Waynesboro, Penna.* 10-page bulletin G-93 illustrates and describes No. 6 CBLM receding chaser collapsible tap for application to special heavy duty vertical tapping machines. Features covered include receding mechanism to provide a positive and precision taper, detachable heads for wide range coverage, and long life circular chasers.

12 ABRASIVE PRODUCTS PRICING *Book—Bay State Abrasive Products Co, Westboro, Mass.* 84-page illustrated spiral-bound book gives new method of pricing products. Rules for calculating list prices; detailed tabular data catalogued on complete line.

13 PRECISION SURFACE EQUIPMENT—*Challenge Machinery Co, Grand Haven, Mich.* 8-page catalog 838-V

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contains illustrated data on angle plates, V-blocks, box parallels, universal right angle irons, and wide range of surface plate equipment.

14 TRACING TEMPLET FOR JIGS & FIXTURES—*Northwestern Tool & Engineering Co, Dayton 3, Ohio.* Templet covers over 800 standard component parts for jigs and fixtures.

15 VIBRODYNE BALANCER—*Tinius Olsen Testing Machine Co, Willow Grove, Penna.* 12-page bulletin 53 gives illustrated information on features and applications of portable unit with standard tunable pickup which can be used for balancing parts or assemblies operating between 225 and 3600 rpm. In-place analysis and correction of unbalance described.

16 CARBIDE GRINDING WHEELS—*Robertson Mfg Co, Trenton 5 NJ.* 4-page bulletin describes and illustrates abrasives for grinding carbide tools. Furnishes wheel sizes, plate specifications, and Robertson blueprint numbers of 23 plate-mounted vitrified wheels for 30 grinding machines made by 16 manufacturers.

17 VIBRATION METER—*Consolidated Electrodynamics Corp, Pasadena, Calif.* Illustrated bulletin 1566 gives data on Type 1-128, lightweight, battery-operated, transistorized instrument. Features, operation, controls, specifications, accessories covered.

HEAT TREATING AND WELDING

18 RESISTANCE WELDING PRODUCTS—*Weldaloy Products Co, Van Dyke, Mich.* 56-page catalog 56 pictures describes, and specifies standard and special spot welding electrodes, seam welding electrode wheels, dies, back-up bars, shafts, and bushings. Includes recommendations and use of special alloys and electrode materials, applications, specification charts on properties of Weldaloy alloys and Weldtung copper tungsten alloys. Glossary of metallurgical processing and production terms included.

19 "OVENS FOR INDUSTRY"—*Kirk & Blum Manufacturing Co, Cincinnati 9, Ohio.* 36-page catalog illustrates wide range of installations. Units for variety applications described.

20 AUTOMATIC WELDING HEAD MANIPULATOR — *Worthington Corp, Plainfield, NJ.* Bulletin R-1700-B18 presents illustrated description of Mast Type Model 10x12. Special features include use of seamless tubing allowing concealment of power and welding cables for maneuverability and safety; telescoping head mount provides manual or automatic precision control of welding head.

PLANT SERVICE EQUIPMENT

21 BARREL FINISHING—*Almco Division of Queen Stove Works, Inc, Albert Lea, Minn.* 52-page illustrated general catalog provides information on Supersheen equipment, basic material on barrel finishing techniques and methods, and utilization of automatic control. Advantages, installations, applications, typical parts processed, equipment and supplies discussed.

22 FORK LIFT TRUCKS—*Towmotor Corp, Cleveland 10, Ohio.* 32-page booklet describes Pace-Maker Series, including four new additions; load capacities of line range from 6000 to 11,000 lb. Design and operating improvements illustrated.

23 PLASTISOL COATING—*Metal & Thermit Corp, Rahway, NJ.* 4-page bulletin SP-1 gives information on chemical resistant Unichrome Super 5300 which can be sprayed in coatings up to 60 mils thick in a single application.

24 TELESCOPIC CONVEYORS—*Wilkie Co, Philadelphia 39, Penna.* 24-page catalog 102 illustrates and describes Flopover Curves and Mobile Dock for loading and unloading.

25 CENTRIFUGAL DUST COLLECTOR—*Research-Cottrell, Inc, Bound Brook, NJ.* 12-page illustrated bulletin 100 contains data on multiple-tube Cyclo-trell. Operation and construction explained; designed details in tabular form for 6 available sizes.

26 ELECTRO-HYDRAULIC MAINTENANCE TOWER—*Safway Steel Products Inc, Milwaukee 13, Wis.* 4-page bulletin pictures and describes Moto-Lift; gives specifications for 3 models; work platform raisable from 7 ft to 17 ft in 25 sec.

27 PRECISION TUMBLING PROCESS —*BMT Manufacturing Corp, Elmira Heights, NY.* 8-page illustrated brochure gives details on multi-barrel slide-honing unit with a 48-in. revolving disk on which can be mounted as many as 14 different barrels. Rotary, centrifugal, and slide tumbling actions can be accomplished simultaneously.

PARTS AND MATERIALS

28 OILITE PRODUCTS—*Amplex Division, Chrysler Corp, Detroit 31, Mich.* 52-page illustrated E-56 Engineering Manual contains complete details on products. Includes data on properties of materials, lists Brinell and Rockwell ratings, discusses applications. Contains 12-page insert listing over 1000 standard sleeve, flange, and thrust bearings; cored, solid bar and plate stock.

29 SHEAVES FOR MULTIPLE V-DRIVES — *Maurey Manufacturing Corp, Chicago 18, Ill.* 17-page catalog MVD-56 presents illustrated information on complete line of Ful-Grip Q-D sheaves, standard Multi-V, and special, made-to-order sheaves. Gives data on handling, as well as dimensions and descriptions; construction and installation details included.

30 POWER TRANSMISSION EQUIPMENT—*Fawick Airflex Division, Fawick Corp, Cleveland 11, Ohio.* 36-page illustrated bulletin 500-A gives design data and applications for clutches, brakes, couplings, power take-offs, rotorseals, quick-release valves, and high-speed controls. Tabular data on dimensions, torque ratings.

31 ALLOY STEEL TUBING—*Babcock & Wilcox Co, Tubular Products Div, Beaver Falls, Penna.* 4-page folder TDC-184 gives information on 12 of the most widely used 4100 Series of alloy steels. Contains condensed data on carburizing and thermal treatments, critical points, mechanical properties, and suggestions for welding and machining.

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PENINSULAR GRINDING WHEEL DIVISION—ABRASIVE AND METAL PRODUCTS COMPANY—DETROIT, MICHIGAN

Bliss Offers Basic Press Line With Unitized Design

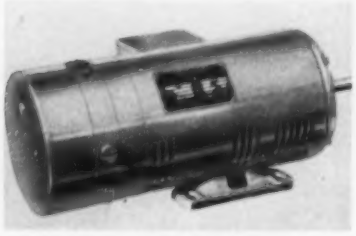
SE-2 line of single-action, eccentric-geared, two-point presses features a quill-mounted flywheel and overhung clutch built into a unitized gear case on which the main motor drive is mounted. Except for the main gears, nothing is built into the crown. As a result, the entire drive can be removed from the press as a unit, and reinstalled, with a minimum of time and effort.

Other maintenance advantages: belts can be replaced without removing anything but brake pins; clutch can be taken off by removing brake bracket; quill assembly can be taken from gear case by removing six screws.

All presses in line are available as "basic" units, with no inbuilding or extras unless specified. Standard features of basic unit include all-welded construction, recirculating oil systems, bronze liners on slideways, and anti-friction bearings on intermediate shaft and flywheel. A variety of special features can be added to the basic design.

Presses are available in a full line of tonnages in both single- and double-geared models.

E W Bliss Co, Canton, Ohio

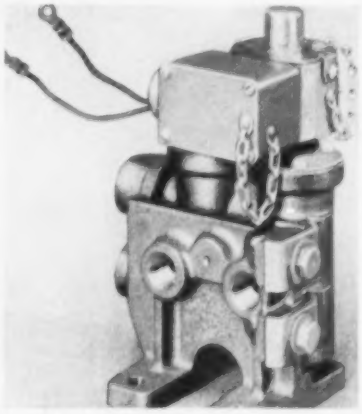


Adjustable Speed Drives

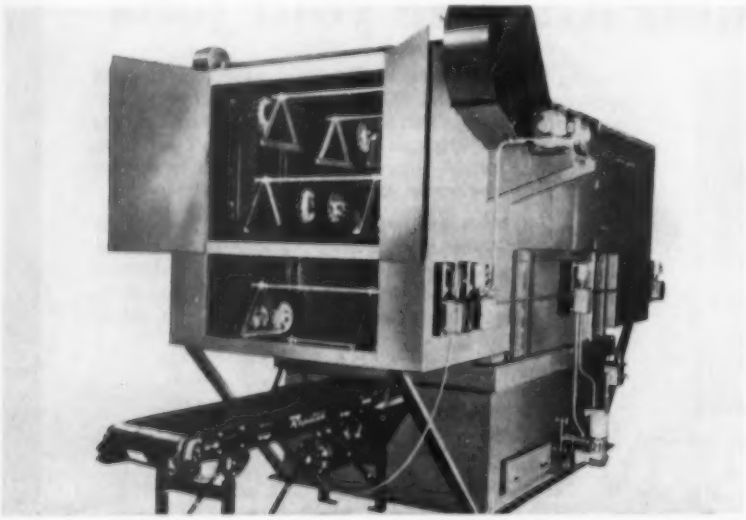
Fractional horsepower Ajusto-Spede drives for fast stopping or cycling have integral electrically operated fail-safe friction brakes available in 18 and 36 lb-in. of torque.

Single package drive consists of ac constant-speed induction motor, eddy-current coupling, friction brake, and electronic control; connection to standard power line is only wiring required. Units have continuous constant torque rating through a 25:1 speed range; speed stability is ±2% of top speed at any point within operating range.

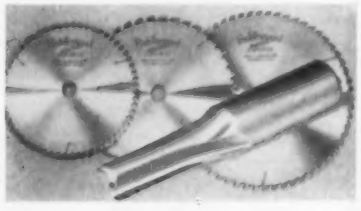
Eaton Manufacturing Co, Dynamatic Div, Kenosha, Wis



FOUR-WAY SOLENOID VALVE, produced for the control of air, water, and light oil to 150 psi, is designed to conform to JIC specifications. Solenoid is inoperative when its cover is removed, and there is a manual override which is safe against accidental actuation. Crescent solenoid is interchangeable with standard solenoids. Valve can be converted to any practical current or voltage, ac or dc, by a simple coil change. Catalog 6-C — *Barksdale Valves, 5125 Alcoa Ave, Los Angeles 58, Calif*



CONVEYORIZED DEGREASER is provided with automatic loading and unloading by motorized belts. Automatic feed is accomplished by special hangers located along the inside cross-rod conveyor system in the machine. Unit is available in electric, steam, or gas-heated models. Vapor level is controlled by water jacket around tank exterior. Conveyor speed is approx 8 fpm, and capacity of unit is approx 3000 lb per hr. Machine is 6 ft wide and 15 ft long—*Phillips Mfg Co, 3427 W Touhy Ave, Chicago 45, Ill*



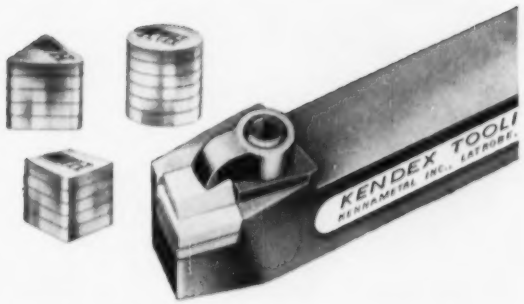
CARBIDE SAWS AND ROUTER BITS in Radialloy-Tipped series are designed for work with such nonferrous metals as bronze and aluminum, as well as wood and plastics. Tips have full steel backing for maximum support. Saws are available in diameter range from 6 to 18 in., with number of teeth varying from 30 to 80. Router bits are available in seven sizes, with length of cutting edge varying from ¾ to 1¼ in.—*Radial Cutter Mfg Corp, 831 Bond St, Elizabeth 4, NJ*

Here's more proof that KENNAMETAL*

K7H

is the best carbide cutting grade . . .

- ✓ for high velocity machining
- ✓ for cutting heat-treated and high tensile steels



Use Kendex Tooling with turn-over inserts (available in 17 styles and over 200 tools) . . . for lowest cost per cutting edge.

1 "Hard-to-machine" steel part finish bored 4 times faster with better dimensional control and better finish

OPERATION: Machine component of forged high nickel-chromium-tungsten content finish bored on a 62" King Boring Mill to size 38" diameter by 23¼" long, with a .014" feed and ⅜" depth of cut.

OLD TOOLING—Results: A special brazed shear tool with a competitive carbide, operating at 70 sfm, became very dull and produced only a fair finish with a slightly tapered bore.

WITH K7H—Results: A K7H cutting insert on a Kendex KSBL Holder, operating at 300 sfm (four times faster than with the previous competitive carbide), showed very little wear and provided *an excellent finish with a straight bore.*

2 Plunge and rough cutting heat-treated steel

OPERATION: Plunge and rough turning a heat-treated 1045 steel cylindrical machine part, operating at 350 sfm, with a .024" feed and ⅛"to ¼" depth of cut.

OLD TOOLING—Results: Carbides previously used produced only 30 to 35 pieces per cutting edge.

WITH K7H—Results: A K7H throw-away type insert in a Kendex tool produced 110 pieces per cutting edge, with much lower tip and holder mortality.

3 K7H produced 8 to 12 times more pieces at twice the speed

OPERATION: A machine tool manufacturer ran this operation on 280 Brinell Hy-ten B-3X steel, with a .021" feed and ¼" depth of cut.

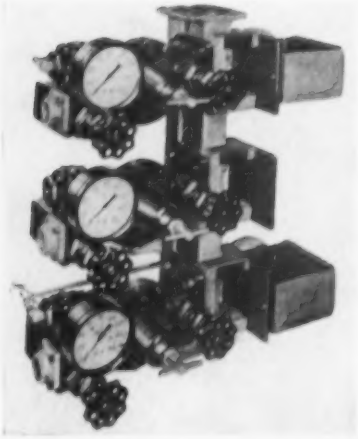
OLD TOOLING—Results: Brazed tools using a competitive grade of carbide, operating at 210 sfm, cut only 2 to 3 pieces per grind.

WITH K7H—Results: K7H inserts on a Kendex Holder, averaged 25 pieces per cutting edge operating at 500 sfm.

The above results are typical performances of Kennametal Grade K7H on job after job. K7H has phenomenal strength (three times that of nonmetallics—even at high temperatures), top resistance to shock plus unusual resistance to wear and cratering. Try it on your hard-to-machine and high velocity jobs. A Kennametal tool engineer will be glad to assist you. Why not call him or write KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark

INDUSTRY AND KENNAMETAL ...Partners in Progress



Clearing Press Air Manifold Has Composite Control Valve

Designed to provide a simple and efficient means of regulating the air supply to the clutch and brake unit, counterbalance cylinders, and die cushions in presses, air manifold combines all valves, regulators, gages, and switches in one compact package.

All the devices necessary to regulate a supply of air have been grouped into a single composite air valve. Elements of this valve include a shut-off valve, pressure regulator, pressure gage with needle throttle valve, check valve, and exhaust valve. These components are mounted on a cast housing measuring only 10 in. from end to end; no intermediate piping has to be done between the parts, all of which are easy to reach from the front when unit is installed.

Company has developed a header which brings together into one package as many composite air valves and pressure switches as are required for complete press control. Headers provide flanges for mounting both the air valve and air pressure switches, and are designed so that when air manifold is bolted to the header, connections are made to both the air inlet and the exhaust simultaneously. Only connections needed for installing the complete manifold assembly are one inlet and one exhaust line. Headers are furnished in 2- or 3-station sizes.

Clearing Machine Corp, Div of U S Industries, Inc, 6499 W 65th St, Chicago 38, Ill

Pneumatic Slide Feed Attaches To Small Punch Presses

Model M-256 air-operated slide feed, with open throat, is intended for fast, automatic feeding on small punch presses. Because of its small size and light weight, it can be moved from press to press or may be left mounted on die sets and stored for frequent re-orders. Device is not a spring-fed feed, and no cam-outs are necessary for its operation.

Feed operates on shop air lines with 50 to 100 psi and takes material up to a maximum thickness of 1/16 in. and 6-in. width in lighter gages. Maximum feed length is 3 in., operating at 200 spm; with shorter feed lengths, correspondingly higher speeds are obtainable.

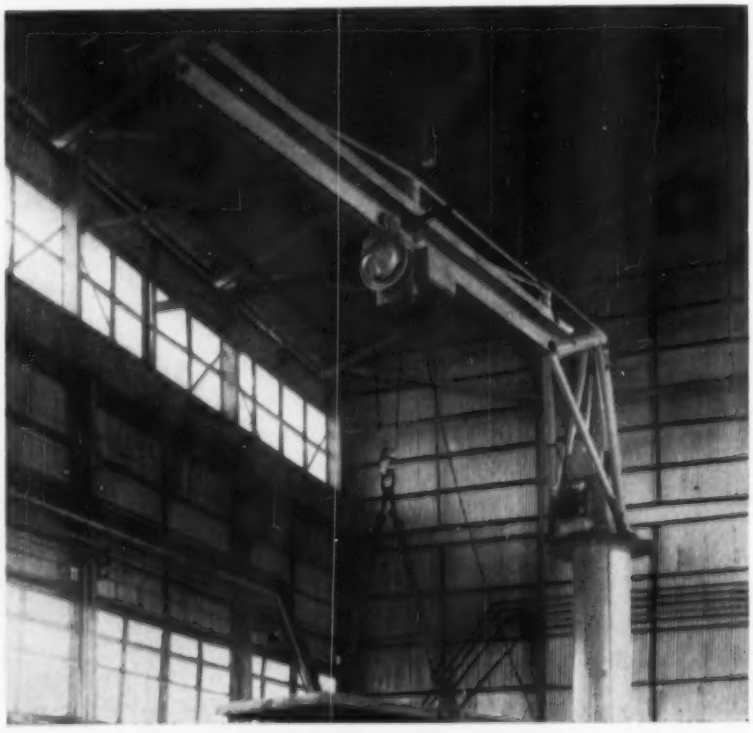
Although feed operates off the press crankshaft, length of press stroke does not affect the feed length. Feed finger has large stock-gripping surface, leaves work unmarked.

Cooper Weymouth Inc, 277 Noble Ave, Bridgeport 8, Conn

Hand screwdriver called Tru-Driver has a swivel handle and a U-bend in the shaft, is available for either slotted- or recessed-head screws. No-slip tip grips screw during work, lets go when work stops.

Mayville Mfg Co, Mayville, NY

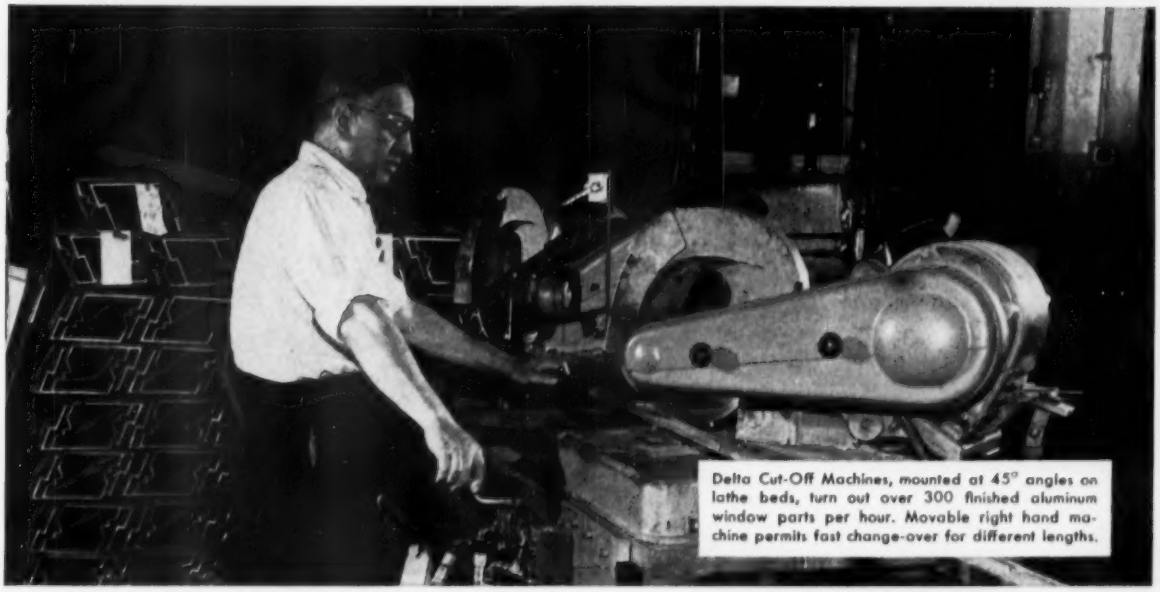
BENCH-MODEL LEAD COMPARATOR, Model SK-1003, has a thread-diameter range of from 0.112 to 2 in. Length capacities, between points, are from ¼ to 6 in. Other sizes and capacities are available on special order. On pieces such as bolts, where thread diameter is smaller than body or head diameter, device inspects threads without driving dog having to be removed from work, and it requires no adjustment to centralize with work centerline. Open-face dial is recessed into a housing mounted on a V-block. Lead of threaded parts is quickly measured by inserting parts into the "V" with portion to be measured held between two adjustable contact points —*Jerpbak-Bayless Co, Solon, Ohio*



POWER-ROTATED JIB CRANE is available in capacities of 6, 7½, 10, and 15 tons. Each crane has a 25-ft boom which, when rotated in a full circle, covers 1965 sq ft of floor space. Electric rotating mechanism, as well as electrically powered hoist and hoist trolley which are available, provide fraction-of-an-inch control. Over-all height above foundation is 17 ft, lift height is 12 ft—*R G LeTourneau, Inc, Longview, Tex*

ROCKWELL-BUILT

DELTA cut-off machines



Delta Cut-Off Machines, mounted at 45° angles on lathe beds, turn out over 300 finished aluminum window parts per hour. Movable right hand machine permits fast change-over for different lengths.

...save cost of expensive special equipment

for General Bronze Corp., Garden City, L.I.

DUAL SET-UPS ARE FAST, ACCURATE—By adapting versatile Delta Cut-Off Machines to handle custom operations with limited production runs, General Bronze eliminated the need for expensive special tooling. The Delta machines give them the accuracy and fast change-over needed to turn out precision work at high speed.

COST LESS TO BUY, OPERATE—Delta Cut-Off Machines not only do precision work fast, but at far less cost. "These Delta machines have been in constant use for at least 15 years," says Joseph Gafney, plant engineer, "and they consistently give us the exacting, trouble-free operation we need."

LITTLE MAINTENANCE, FAST SERVICE—According to Mr. Gafney, the little maintenance that's been needed over the years has been done quickly and easily. "Delta salesmen have given us fast, dependable service when we've needed it," says Mr. Gafney.

SEE THE ENTIRE DELTA CUT-OFF MACHINE LINE: Wet Abrasive—Dry Abrasive—Non-Ferrous Metal, Wood. Get all the facts—compare for quality, for performance. Then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages.

Send for all the facts today!

Delta Power Tool Division, Rockwell Manufacturing Co.
618H N. Lexington Ave., Pittsburgh 8, Pa.

- ☐ Please send catalog on entire Delta Cut-Off Machine line.
- ☐ Please send Fact Book on using Delta Power Tools teamed with machine tools.
- ☐ Please send name of my nearest Delta Dealer.

Name_____ Title_____

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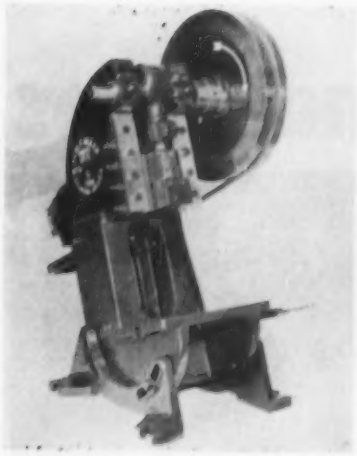
DELTA ROCKWELL

another product by **ROCKWELL**



Allen 5-Ton Bench Punch Press Performs Variety of Operations

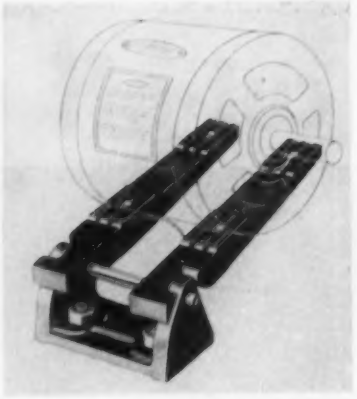
Model B-5 punch press will perform up to 280 operations per minute on continuous punching, shearing, forming, riveting, blanking, cutting, and drawing in a variety of materials. Heavy 65-lb flywheel assures ample power for heavy-duty work.

Features include upper connecting rod—ram assembly in alignment, in conjunction with heavy crankshaft and machined die bed; large crankshaft-bearing surface on connecting rod; ram adjustable for die setting with standard wrenches; and 6-in.-long ram guides.

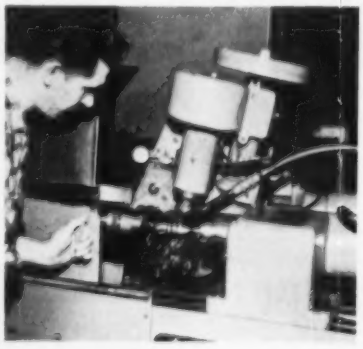
Standard stroke is 1¼ in., with ¼ to 2-in. strokes available at additional charge. V-belt drive of 265-lb machine requires 1/3-hp motor. Price is $199.50, complete with brake, motor mount, V-belt, and motor pulley.

Alva Allen Industries, Clinton, Mo

DRILLPRESS VISE called Speed Vise eliminates need for jigs and fixtures on simple drilling operations. All that is needed is a jaw plate designed to fit the part being drilled. Unit is constructed of extra-heavy semi-steel castings and is provided with a heavy base plate for rigidity—*Cardinal Machine Co, 1819 Dana St, Glendale, Calif*



MOTOR BASE for V-belt drives automatically compensates for belt stress and maintains belt tension for all load conditions. Known as the Auto-Tension, it is available in four NEMA motor-frame sizes from 1/6 to 7½ hp, and is designed for use with horizontally positioned drives. It is not designed for use on wall or ceiling mountings. Base requires no maintenance; belts can be changed without disturbing the mounting. Bulletin No. 1300—*Lovejoy Flexible Coupling Co, 4878 W Lake St, Chicago 44, Ill*



STEERING-GEAR SECTORS are hobbed on modified version of Model 1458 hobber, which feeds the hob across work by a hydraulic cylinder mounted on the main head section. In addition, hob is fed at an angle to the axis of work to produce the tapered teeth required. Because there is no previous machining on the sides of the sector blank, there are variations in the rough forging; to overcome effect of these variations, special collet-type holding and aligning fixture is used. Hydraulically actuated tailstock maintains pressure on part during machining, also operates the clamping fixture. Hourly production is 45 parts—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich*

Controlled-Atmosphere Furnace Hardens Tool Steels

Model GA-4 toolroom furnace, designed for the general hardening of tool steel, has automatic controls for furnace, generator, temperature and gas curtain. Chamber dimensions are 10 x 8 in., and power plant input is 8 kw. at 230v, single or 3-phase, for operation to 2000 F.

Atmosphere system consists of a cracking unit to which is fed, by means of a variable-speed pump, a mixture of alcohol and water proportioned to the type of treatment desired. This mixture is cracked into gas of a controlled analysis to maintain the correct carbon potential for equilibrium with the steel being treated.

To insure a good seal, furnace is equipped with a welded Inconel retort which prevents heating elements from being exposed to the atmospheric gases, which are confined to the retort chamber.

Cooley Electric Mfg Corp, 35 S Shelby St, Indianapolis, Ind

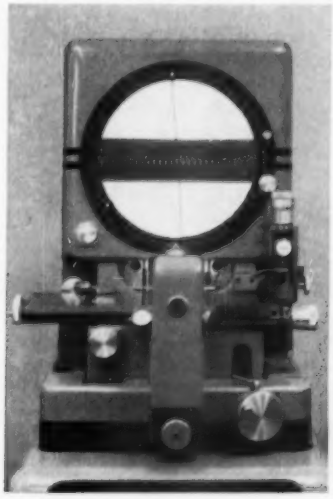
Whiteprinting machines, twin-table models called Champion and Spartan, are 42-in. units which will expose and develop ammonia-type whiteprints up to 32 fpm. Champion has automatic copy operation, making it a one-step feed machine; Spartan requires manual copy separation, resulting in two-step feed operation. Both models have a 3000-watt mercury lamp for rapid printing. Machines will reproduce any translucent copy, such as engineering drawings, tracing, maps, film, and letters. Speed control is provided by GE Thymotrol electronic drive.

C F Pease Co, 3991 N Rockwell St, Chicago 18, Ill

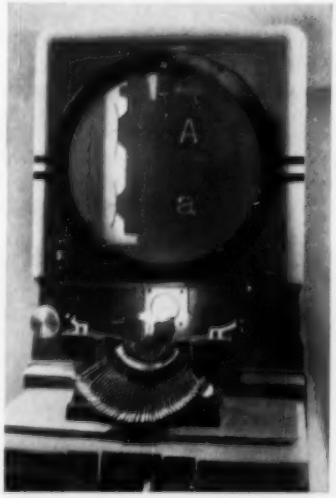
How many places in your plant can projection gaging save time and money?

In the toolroom? Look at this. Prior to adopting projection gaging, a Midwestern manufacturing plant required 725 man-hours monthly to inspect flat drills, taps, special cutters, and circular form tools. Use of a Kodak Contour Projector reduced inspection time 84% to 115 man-hours; cost of the projector was returned in direct labor savings within three months. If you have a heavy inspection load in your toolroom, chances are that optical gaging with Kodak Contour Projectors could effect similar savings for you.

In receiving? Here's the experience of a leading maker of aircraft engines. Their gaging procedure on jet engine blades called for inspecting 11 dimensions (including radii and angles) on the dovetail contour, 14 additional dimensions on the blade root. Using two Kodak Contour Projectors, they checked these pieces at a rate of 150 per hour. And operators required little training. What about your receiving inspection department? Couldn't a fast, highly accurate method of inspecting all sorts of parts with multiple dimensions and complex shapes help prevent bottlenecks?



In production? A lot of people don't think of optical gaging in terms of production inspection. A typewriter maker did. To check the alignment of type bars to ±.0002", they placed a Kodak Contour Projector next to the soldering jigs on which bars are mounted on their arms. Catching errors at this point and correcting the jigs reduced alignment time in final assembly 25%. Install Kodak Contour Projectors next to production equipment and you have a fast, continuing check that insures machine settings are correct. That's a good way to keep scrap costs down and quality up.



In final inspection? Ever have a part that was almost impossible to inspect accurately and completely? A leading West Coast electronics manufacturer did. They had to check the precise pitch of a fine wire helix mounted in its glass tube. "Without the Kodak Contour Projector," the company reported, "it would not be practical to make the measurements necessary to get a satisfactory instrument." Many times optical gaging on a Kodak Contour Projector lets you measure small or easily distorted parts with a simplicity and accuracy you can't achieve by other methods.

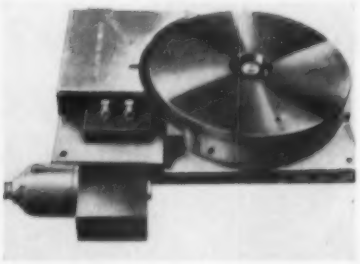
WHATEVER your inspection or measuring problem, there's a Kodak Contour Projector to do the work, from the bench-type Model 8 to the big Model 30 with its 30-inch screen and large part capacity.

To find out more about how optical gaging can save you time and money, improve accuracy, send for the booklet, "Projection Gaging with Kodak Contour Projectors." Write *Special Products Sales Division.*

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Kodak



Compact Index Table Has All-Hydraulic Action

Designed for use in a variety of machine-tool operations, index table features compactness; dimensions of the sub-base are only 4¼ x 15 x 21¾ in. Electrically controlled unit is hydraulically operated, contains no gears, cams, or mechanical pawls.

Table, which is parallel within 0.0001 in., can be synchronized with automatic cycling of machine, and a micro-switch insures safety in operation. Shot pin is held in place hydraulically for positive positioning on any index, from 3 to 120, and guaranteed to 0.0003-in. tolerance, without accumulation, on a 12-in. gaging diameter. Index may be changed easily by the replacement of a bronze bushing on the main indexing cylinder rod.

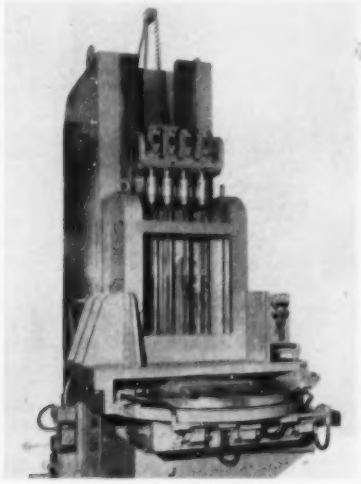
Fixture is operated by a 4-way valve and solenoid with spring return. Valve can be mounted on fixture or on machine. Fixture top has a centerline taper adaptation to make all tooling interchangeable.

Automation Mfg Corp, 8070 Wheeler Ave, Detroit 10, Mich

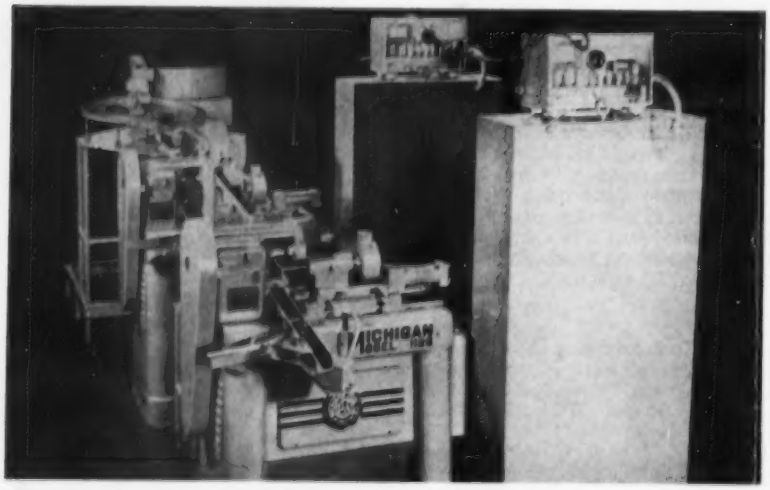
Rousselle Press Features Increased Die Space

Model 2E, 15-ton Rousselle press, built for heavy, continuous production, has a die space of 12-in. Clutch mechanism can be set for single stroke or continuous operation. Set-up operation is facilitated by roller-bearing inclinable device. Other specifications: strokes per min, 180; standard stroke, 2-in.; area of bed, 11-in. x 16-in.; motor requirement, 1-hp, 1800 rpm.

Service Machine Co, 2310 W 78th St, Chicago 20, Ill



AUTOMOTIVE LEVER ARMS are automatically broached at rate of 560 per hr on 15-ton, 66-in.-stroke pull-up machine. Unit punches holes with ⅞-in. max dia; finished dia is 1-5/64 in. Four broaches are pulled through the lever-arm holes on each broaching stroke. Five different parts may be broached by mounting their corresponding set of faceplates on the rotary indexing fixture, which is automatically indexed by a hydraulic circuit interlocked with the machine circuit—*Colonial Broach & Machine Co, Detroit 13, Mich*

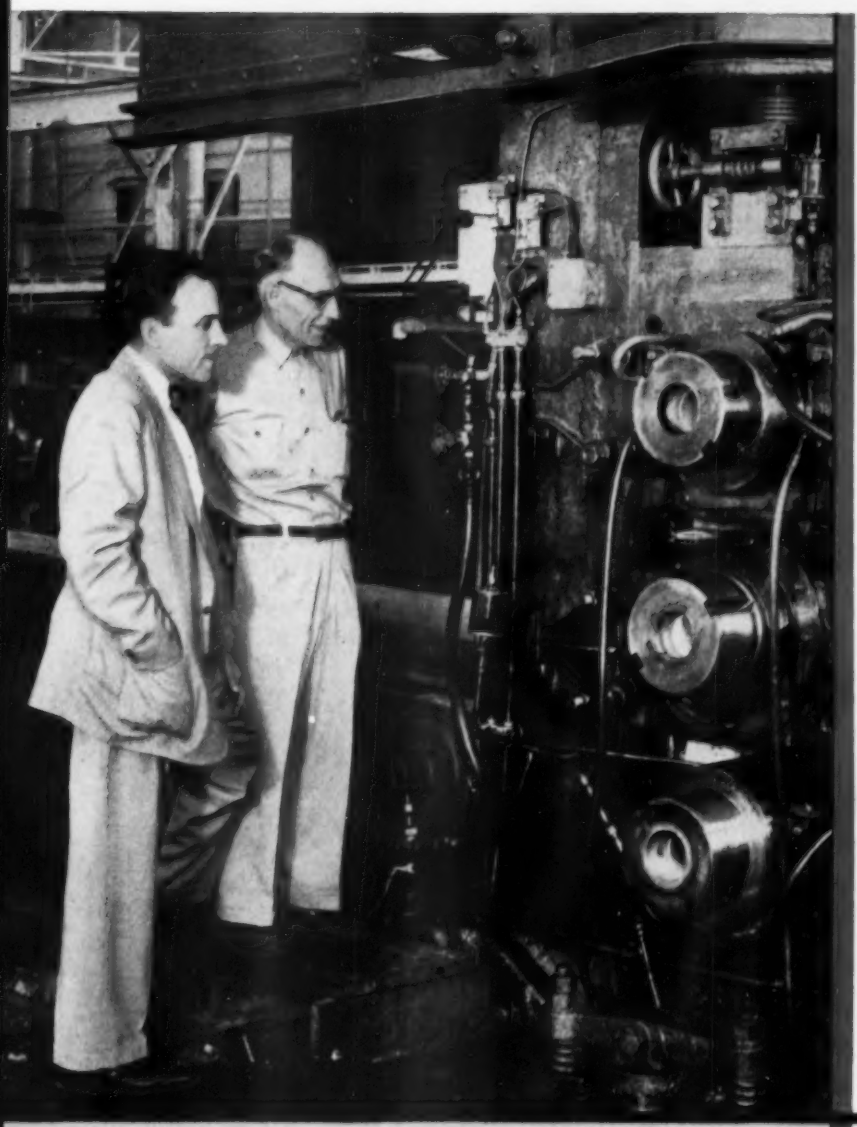


AUTOMOTIVE-TRANSMISSION GEARS are automatically sound-tested on Model 1126 gear speeder. Operation consists of feeding parts from a storage hopper, clamping and speeding of the gear, and either rejection for excess noise in any frequency band or passing through of the part. Electronic audio inspection eliminates need for depending on operator's hearing; electronic panels can be set to reject gears for undesirable noise levels of high, low, or intermediate frequency at particular speeds within working range of each gear—*Michigan Tool Co, 7171 E McNichols Rd, Detroit 12, Mich*

Contour-Projector accessories for Kodak Model 8 increase the usefulness of the machine. Special glass measuring stage, for use in vertical projection, permits making linear measurements on the projector over a range of 2 ×1 in. Stage is available with micrometers calibrated either to 0.001 in. or 0.0001 in. For measuring angles, company has developed a rotary screen which replaces the standard ground-glass screen and is used in either horizontal or vertical projections. Vernier scale permits direct reading to 5 min of arc. Third accessory, for use in horizontal projection, is an overlay chart holder, permitting use of existing plastic or ground glass charts of varying sizes on the instrument.

Eastman Kodak Co, Special Products Sales Div, Rochester 4, NY

Sick slab roll recovers fast with application of STANOGEAR *Compound*



Eugene Ewald (right), Mill Foreman, and Marshall Fox, Standard Oil lubrication specialist, inspect slab roll. STANOGEAR Compound helped solve lubrication problem on roll neck bearings.

Marshall Fox who proposed switch to STANOGEAR with resultant improved operation, is experienced in providing such technical service. Marsh has a Mechanical Engineering degree from Purdue to qualify him for this work. In addition, he has completed Standard's course for sales engineers. This experience and training, customers find, pay off for them.

A slab roll at Matthiessen & Hegeler Zinc Company, La Salle, Illinois, was sick. It suffered from repeated roll neck bearing failures. Bearing temperatures couldn't be controlled. A consultant was summoned—Marshall J. Fox, Standard Oil lubrication specialist. His diagnosis and remedy: Install STANOGEAR Compound and equip the machine with a central pressure system for application. Recommendations were followed. Result: No bearing failures, due to faulty lubrication, since. Maintenance costs reduced. Time lost through breakdowns slashed.

This was a condition made to order for STANOGEAR to remedy. And Matthiessen & Hegeler knew there was a man at hand who could suggest what should be done. It's another demonstration of what this unbeatable combination can do when put to work:

1. **Standard Oil lubrication specialists capable of giving technical help.**
2. **Top quality products *that deliver results required.***

STANOGEAR Compounds contain special additives making them suitable for applications where heavy loads cause welding, seizure or scoring.

In the Midwest and Rocky Mountain states, a Standard Oil lubrication specialist in your nearby Standard Oil office will gladly give you more information about STANOGEAR. Call him. Or contact Standard Oil Company, 910 So. Michigan Avenue, Chicago 80, Ill.

STANDARD

STANDARD OIL COMPANY

(Indiana)

Small Parts Feeder Counts and Releases in Single Motion

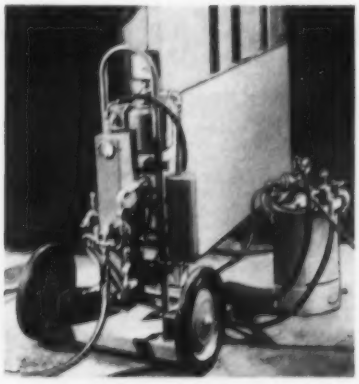
Designed for feeding small parts such as nuts, bolts, and screws, the Hopperal uses an oscillating motion and selectively arranges the pieces on an internal track, permitting them to file out to the outside track and down to required position. A selector gate rejects pieces not properly positioned.

Unit comes with either single or multiple tracks and can be designed to feed two different parts from the same hopper. Having its own motor and controls it will operate anywhere; applications include assembly, inspection, gaging, sorting, production loading, and similar operations.

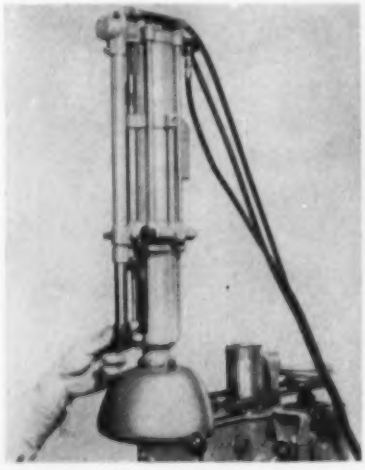
The tracks are rigid enough for lengthy extensions and can be easily replaced with others to feed different items.

Haberstump-Harris, Inc, 10463 Northlawn Ave, Detroit 4, Mich

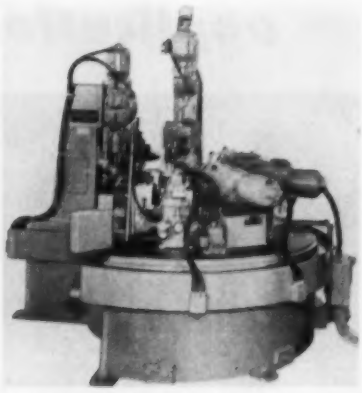
PITCH RACKS, Type AG, for use where rotary motion must be converted to straight line, are cut to AGMA Precision 1 tolerances. Available in 48, 64, and 96 pitch 20° pressure angle to run with PIC type G stock precision spur gears—*PIC Design Corp, 160 Atlantic Ave, Lynbrook, LI, NY*



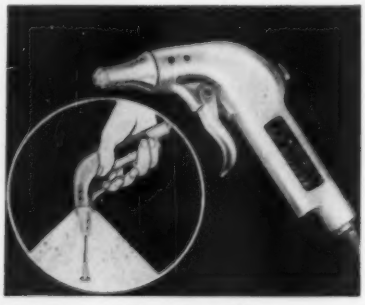
PORTABLE PAINT HEATER is mounted on a two-wheel cart, makes possible the moving of painting equipment to the job site. Unit is made with either three or six-kilowatt heaters, with the latter model producing enough heat so that more than one spray gun can be used. Material to be spray-applied is heated in the heat exchanger, where the transfer of heat from water to paint is effected. Temperature of water is controlled by thermostat—*DeVilbiss Co, 300 Phillips Ave, Toledo 1, Ohio*



AUTOMATIC DRILL-FEED ATTACHMENT for drillpresses makes full cycle at a touch on footpedal: fast approach, drilling at a set speed and depth, another rapid approach, another drilling operation, then retraction to starting position. Unit is air operated and hydraulically controlled. Three control knobs adjust all operations, such as length of approach, drilling speed, and drilling depth, to an accuracy of ±0.002 in. Operations performed by multi-speed unit include skip drilling, tapping, reaming, threading, counter-boring, and fly-cutting—*General Pacific Corp, 8740 Washington Blvd, Culver City, Calif*



BRASS THROTTLE SHAFTS are machined on 12-station horizontal indexing drilling and milling machine, which produces 600 parts per hr at 100% efficiency. Operations performed include drilling, tapping, slotting, straddle milling, and broaching. Five cam-feed drill units, one leadscrew tapping unit, and one air-operated broach are used to process the parts. Parts are loaded in a vee-block with hand-screw clamp and automatically indexed through the processing cycle—*Hartford Special Machinery Co, Machine Tool Div, 282 Homestead Ave, Hartford 12, Conn*



Safety Air Gun Provides Air Umbrella for Protection

Called the Guardair, air gun utilizes principle by which an air stream is diverted through fluted passages to set up a conical shield of high-pressure air which helps prevent chip flyback. Protective screen operates simultaneously with the air jet, so that gun cannot be used without the safety feature.

Gun is of pistol type, designed to fit the hand. Air release is trigger actuated. Adjustable knurled stop-nut controls the output of air and allows repetitive use at controlled pressures. Air seepage and bleeding are eliminated by a leakproof valve which is an integral part of the gun.

Union Engineering Corp, South Hadley Falls, Mass

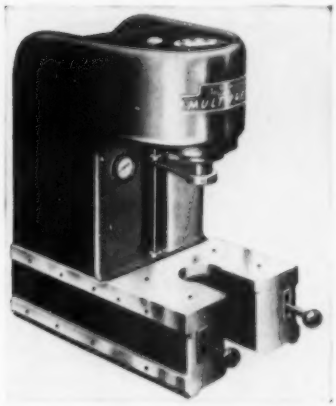
Another production improvement with

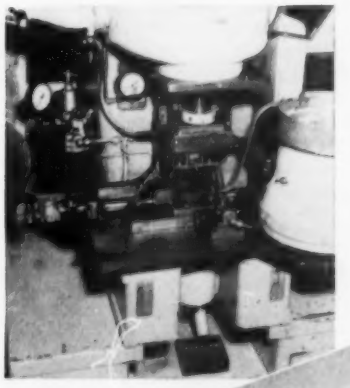
DENISON

MULTIPRESS

Multipress® Automation turns out 48,000 assemblies a day

Denison Multipress pierces, forms, cuts off, positions and spot welds stainless strap to washers





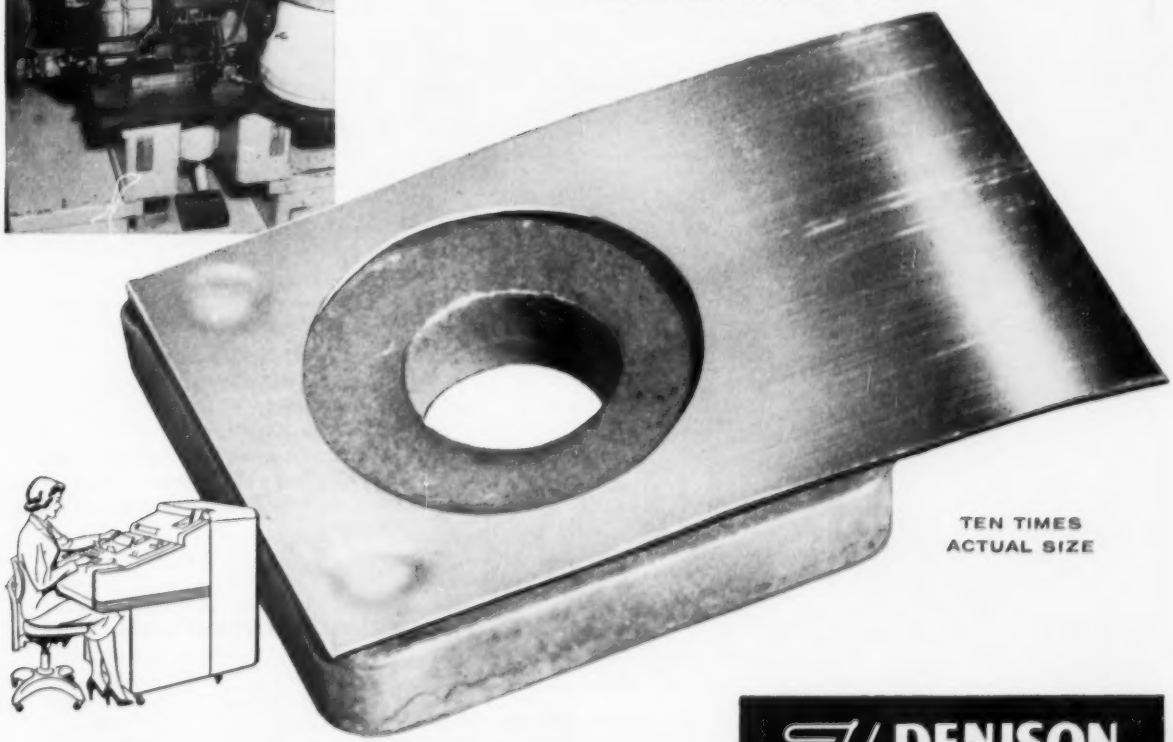
100 assemblies per minute . . . that's the production turned out by one Denison Multipress at International Business Machine Corporation, Poughkeepsie, New York.

Stainless steel tape is fed through a hitch feed into a punch and die set where it is pierced, shaped, and cut off forming a damper guard to cushion the action of a relay armature. It is then positioned under welding electrodes and welded to a square steel washer.

All operations are automatic . . . accurately timed to the stroke of the ram.

Ask a Denison field engineer to show you how to put Multipress to work in your plant. He will demonstrate exactly where and how you can save money on your operations . . . now. Write us.

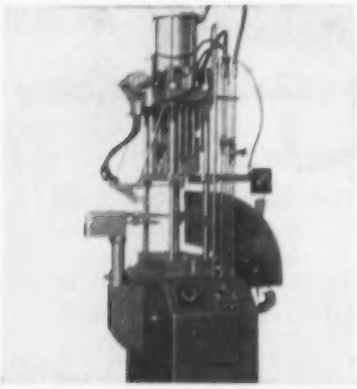
THE
DENISON ENGINEERING COMPANY
1164 Dublin Road • Columbus 16, Ohio
A Subsidiary of American Brake Shoe Co.



TEN TIMES ACTUAL SIZE

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

DENISON *HydrOILics*



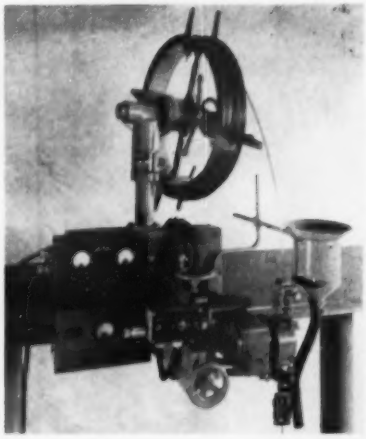
Stokes Compression Molder Is Designed for Short Runs

25-ton automatic, air-operated compression molding press of simplified design, Model 725, is intended as a low-cost unit for use on short production runs where low mold costs and quick mold setup are desired. Press can be equipped with a universal chase plate which permits cavities to be changed quickly without taking the chase plates from the press. Machine also has an adjustable 3-station rotary feeder, a separate cam-actuated air-ejection system, and an air-operated push-off which can be sequenced in at any point in its open cycle.

Press exerts pressure by means of a 7-in. main ram cylinder whose action is multiplied by a toggle arrangement to provide fast initial closing and relatively slow final closing. Over-all dry cycle time is 5 sec, including feeding, closing, opening, and ejection (but exclusive of curing).

F J Stokes Corp, Plastics Molding Equipment Div, 5500 Tabor Rd, Philadelphia 20, Penna

MAGNETIC SEPARATOR AND FILTER, Delpark Up-Flo, has permanent bar-stock bronze screen, cleaned by air which shakes embedded particles from it. Magnetic-separation method makes use of a flat magnetic field onto which the liquids are diffused; force of gravity assists this field. Up-Flo action carries liquids up through the 0.004-in. bar-stock screen to remove particles such as abrasives which do not respond to the magnets. Liquid flows into a storage tank, where settled particles smaller than 0.004 in. are removed by chain-driven flights —*Industrial Filtration Co, Dept UM-287, Lebanon, Ind*



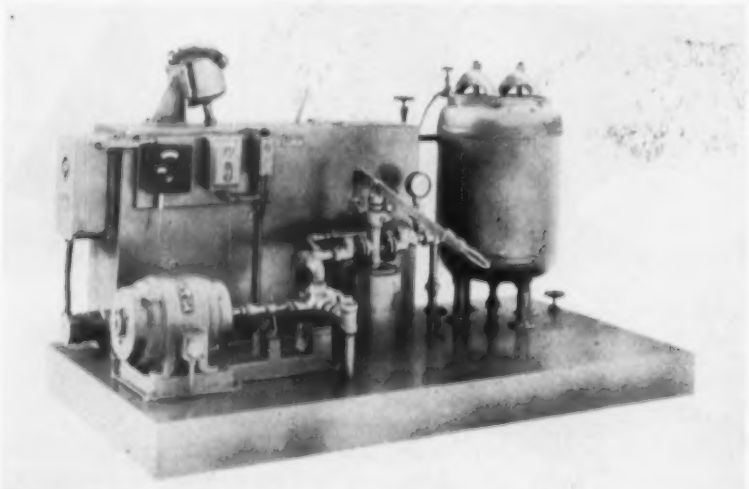
Welding Apparatus Designed For Submerged Melt Welding

Three models comprise an improved line of welding heads and assemblies designed for submerged melt welding. UEH-1 (illustrated on OM-48 side beam carriage for straight-line welding) is a heavy-duty unit which uses electronic voltage control and feeds wire up to 5/16-in. diameter at currents up to 2000 amp.

UEH-2 and USH-2 welding heads are of the same general construction but are smaller. UEH-2 uses an electronic speed control for constant-potential welding, while USH-2 uses standard arc voltage control. Both machines accommodate wire up to ¼-in. diameter and currents up to 1200 amp.

Equipment can be used with presently available controls and carriages without changing wiring. Folder No. F-50188.

Linde Air Products Co, 30 E 42nd St, New York 17, NY



HIGH-PRESSURE IMPREGNATOR is designed to seal porous castings with a metallic sealant, eliminating need for a time-consuming vacuum cycle. Compact unit comes mounted all on one platform, covers only 21 sq ft of floor space. Gas, steam, or electricity can be used as a heating medium, and machine operates on 220 or 440 ac. It can also be built to specification in all sizes to meet individual needs—*Tincher Products Co, 2023 S 60th St, Milwaukee 14, Wis*

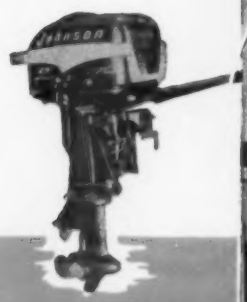
Degreasing basket is constructed of 16-gage Monel metal highly resistant to acids and organic compounds. Basket measures 21½ x 13½ x 13½ in. Handles are provided at both ends, outside frame is supported by braces.

Wiretex Mfg Co, Inc, 40 Mason St, Bridgeport 5, Conn

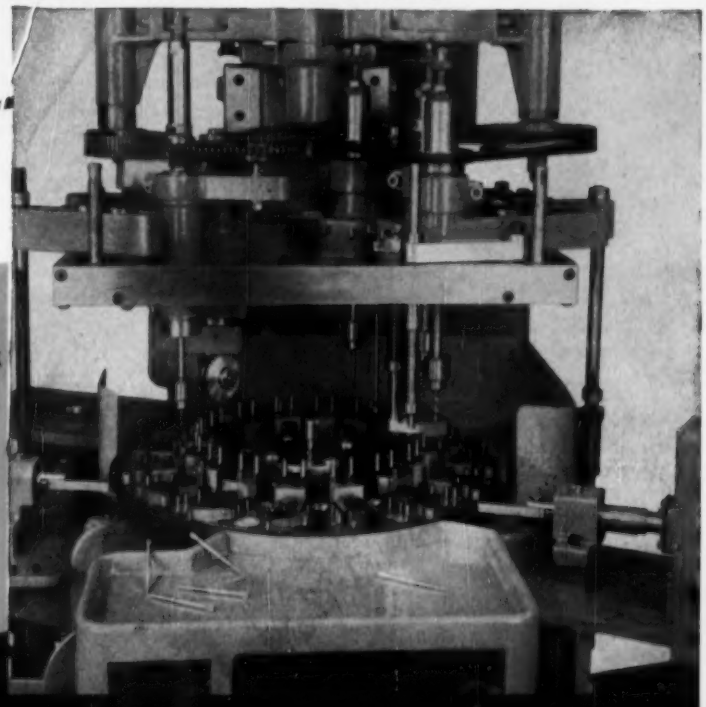
Flatness-measurement device named Mono-Light contains a helium lamp which reportedly makes possible accurate measurements up to 1 light band. Self-contained unit comes in a portable metal case, has an opal-glass lighting area of 4½ by 7½ in. Price is $79.50 fob.

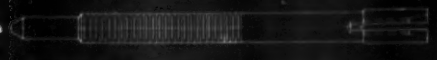
Spitfire Tool Co, 2931 N Pulaski Rd, Chicago 41, Ill

Bodine CASE HISTORY NO. 39



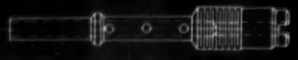
PROCESSING 3 PARTS
22 VARIATIONS
FOR
JOHNSON "SEA-HORSE"
OUTBOARD MOTOR





1. NEEDLE VALVE:

Drill hole 1¾" deep in top end. Countersink hole to ⅞" dia. 25° included angle. Mill .035" slot 1⅛" deep down center axis of hole, vertical milling spindle. Tap hole 6-32 NG-2 to ⅝" deep. Production 750 pieces per hour . . . in 11 lengths . . . 2½" to 4½".

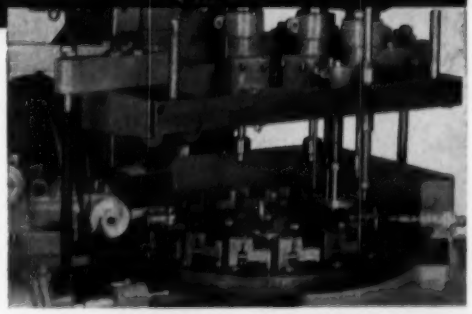


2. HIGH SPEED NOZZLE:

(Vertical milling spindle removed; horizontal spindle substituted.) Seven different nozzles, 1 to 3 holes of different diameters produced. Meter holes drilled through one side and a hole 1¾" deep in small end of nozzle. Mill 1/16" slot, 7/16" deep in top end of nozzle with horizontal milling spindle. Production, 1500 pieces per hour.

3. FLOAT VALVE SEAT:

Processed with 4 variations in the inside dia. of seat. Two I.D. diameters combination reamed to .004" (T.I.R.) concentricity with clamping dia. Valve seat rough and finish faced, depth tolerance .005". Mill ¾4" slot, ⅛" deep (horizontal spindle). Production, 1100 pieces per hour.



The three jobs detailed above are produced on the Bodine standard Model No. 41-20 . . . by means of a changeover of two horizontal indexing dials and sets of spacers for the variety of lengths of the needle valves.

All parts are hand fed, automatically positioned and clamped. The needle valves are automatically unclamped and unloaded by hand to protect the needle points. Other products are automatically ejected.

The installation of the vertical (photo above) and horizontal (photo at right) milling spindles with the other tools saved an extra handling on all three jobs.

All operations are held to close tolerances. Bodine offers 4 standard-size models which will perform Drilling, Tapping, Milling and Screw Inserting. Operations may be combined as required . . . or machines may be tooled for assembly only, with hopper feed and transfer mechanism for completely automatic production.

Bodine automatics will give you tomorrow's production today. Send us your tough problems . . . we may solve them to your competitive advantage.

Write Dept. AM-8 for the Bodine Case History Brochure.

"You Can't Meet Tomorrow's Competition with Yesterday's Machine Tools"

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING AND SCREW INSERTING MACHINES

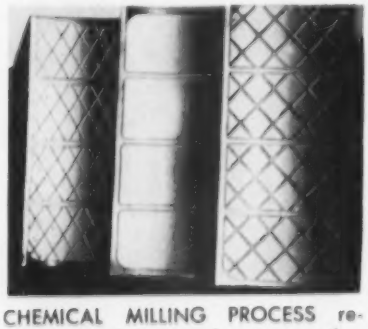
Air-Operated Impact Hammer Operates at 6500 Cycles per Min

Model 150-RH impact hammer is a high-speed repeating or vibrating hammer, using a comparatively small (1-in.-dia) hammer pellet at constant stroke, with variable air pressure. Contact of tool with work opens the hammer valve, and so long as pressure is maintained by the foot pedal the hammer shuttles up and down at 6500 cycles per minute.

Machine is said to be highly effective for riveting, light swaging, and upsetting, as well as planishing in sheet metal and crimping of seams. In driving pins and pressure-assembling, it "walks" parts into place without strain on parts.

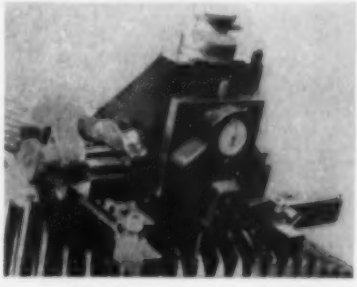
Other specifications: height, 14 in.; width, 6 in.; throat clearance, 3⅛ in.; vertical clearance, 7 in.

Heidrich-Nourse Co, 631 E Third St, Los Angeles 13, Calif



CHEMICAL MILLING PROCESS removes metal from airframes or other parts by chemical etching to achieve minimum weight without sacrificing required strength. Process accommodates complex shapes, makes possible removal of metal on more than one side of a part at one time, and eliminates restrictions on direction of cut, shape of part, or radius of cutter—*U S Chemical Milling Corp, 9999 W Jefferson Blvd, Culver City, Calif*

ULTRASONIC TRANSDUCER for cleaning, degreasing, pickling, plating, and other processes is called Sonicell Type T-2; unit is completely sealed, metal-jacketed, stainless-steel-lined, and thermostatically protected. Treatment chamber is 20 in. long, 8 in. wide, and 6 in. deep, with a liquid capacity of 2½ gallons. Resonant frequency of 20 kc per sec provides maximum cavitation energy above range of human audible perception. Unit is powered by company's Model 400 ultrasonic generator, which is continuously variable in frequency from 10 to 1200 kc and has an output of 400 watts—*General Ultrasonics Co, 1240 Main St, Hartford, Conn*



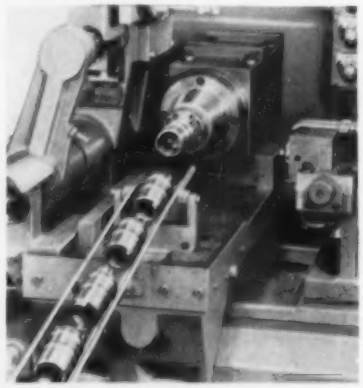
Portable British Instrument Measures Gear Profiles

Designed primarily for use on large-diameter gears, such as in turbines, where accuracy of profile has to be maintained within fine limits, portable gear-profile measuring instrument will cover gears ranging from 18 in. to 16 ft in diameter, and is reported equally efficient for testing spur or helical gears.

Device is mounted on gear by three spherical locators; six sets of these locators, ranging from 5/16 to ¾ in. in diameter, are supplied with each instrument. Horizontal and vertical slides are traversed by micrometer screws, and can be set in any desired position to within 0.0001 in. Vertical slide carries a spherical-ended stylus which operates a dial indicator graduated in ten-thousandths.

Accuracy of gear profile is checked by measuring a series of predetermined horizontal and vertical coordinates. Instrument is made by David Brown Tool Div of Huddersfield, England.

Imported by Morey Machinery Co, Inc, 583 Lafayette St, New York 3, NY



STEEL SLEEVE FOR OIL-PUMP DRIVE is machined on standard Style 2112-B precision boring machine with special adaptation for automotive maker. Two grooves are cut in the part at a production rate of 250 pieces per hr. Other similar machines can be formed into a battery which, when joined by transfer mechanisms, becomes a high-production automation assembly—*Ex-Cell-O Corp, 1200 Oakman Blvd, Detroit 32, Mich*

BEARING MARKING MACHINE, Model 385, is operated by a remote hydraulic unit. Unit is equipped with adjustable feed and discharge chutes, and has throat adjustment to accommodate bearings from 15/16 to 3⅞-in. diameter and thickness from ½ to 1⅜ in. Feed spiders are available to fit each bearing diameter. Hydraulic unit consists of 12-gpm pump, 60-gal tank, and 10-hp motor. It develops 30 tons pressure, which will sink lettering dies engraved 0.025 in. deep. Variable drive provides marking capacity of from 1250 to 1680 bearings per hr on machine, which requires no operator—*Geo T Schmidt, Inc, 4100 Ravenswood Ave, Dept AM, Chicago 13, Ill*

New DynAC® stops motors *instantly*...without a ripple!

Here's dramatic proof of the smooth, controlled braking action of the new Westinghouse DYNAC braking controller. Motor stopped *instantly*—without disturbing the water in the glass goblet. "Grabbing" or jerky stops are eliminated with DYNAC braking.

Wherever rapid and/or controlled stopping is required, DYNAC can not only contribute an important safety factor, but it can save you headaches—*and money*—on: (1) production time, (2) material rejects and spoilage, and (3) maintenance expense.

Because it's *completely* electrical, DYNAC requires no mechanical apparatus or motor linkage—it simplifies maintenance. And it comes in *one* compact, spacesaving enclosure. Get the facts on DYNAC's many cost-cutting applications—with every type of standard induction motor. Use the coupon below for more information on DYNAC. J-30200

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Please send me descriptive bulletins 15-600 and B-6572 on the new DYNAC braking controller.

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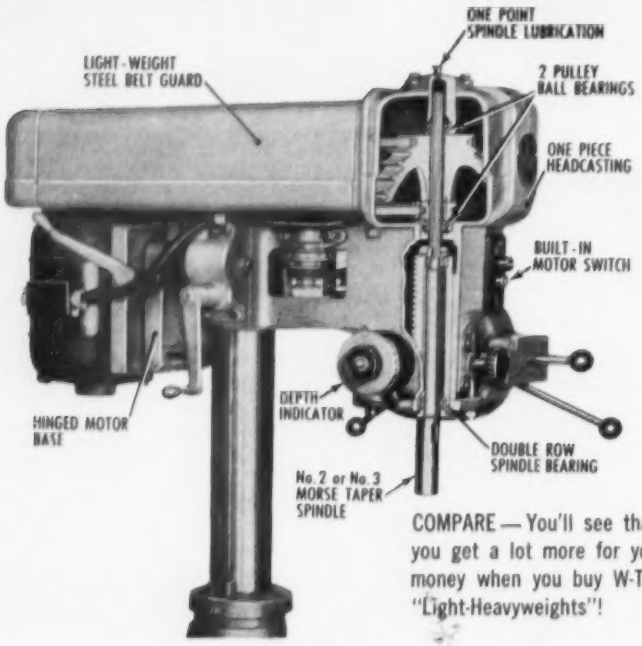


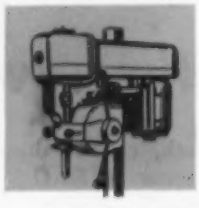
COMPARE — You'll see that you get a lot more for your money when you buy W-T "Light-Heavyweights"!

Here's the inside story of fast, accurate production!

The features you see here add up to unusually fine engineering — the kind you normally find only on heavy, expensive drill presses. But Walker-Turner's 20" press gives you the combination you want — high production rate, at low initial cost.

You can have this W-T 20" Drill Press with hand feed, power feed or the new W-T Air Feed — in bench or floor models; you can set it up in any number of multiple spindles.

1100 Series — Walker-Turner "LIGHT-HEAVYWEIGHT" 20" Drill Press: 6" spindle travel. 10 spline manganese steel spindle. Unusually wide range of speeds — 260 to 2600 rpm, with 1140 rpm motor. Capacity to 1" in cast iron.



Ask your Walker-Turner Distributor to show you what this husky drill press can do for you. He's listed under "Tools" in your phone book's Yellow Pages. Or write for his name and we'll send full descriptions.

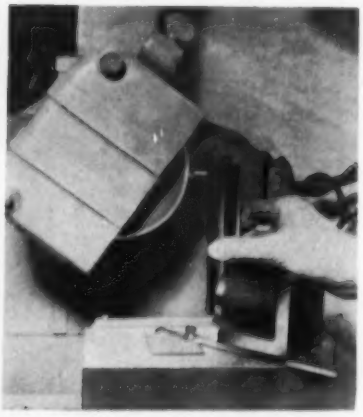
DRILL PRESSES, HAND AND POWER FEED — AIR FEED DRILL PRESS ATTACHMENT — RADIAL DRILLS — WOOD AND METAL CUTTING BAND SAWS — TILTING ARBOR SAWS — RADIAL SAWS — JIG SAWS — CUT-OFF SAWS — LATHES — SPINDLE SHAPERS — JOINTERS — BELT AND DISC SURFACERS — FLEXIBLE SHAFT MACHINES

walker-turner

WALKER-TURNER
INCORPORATED
Plainfield, N. J.

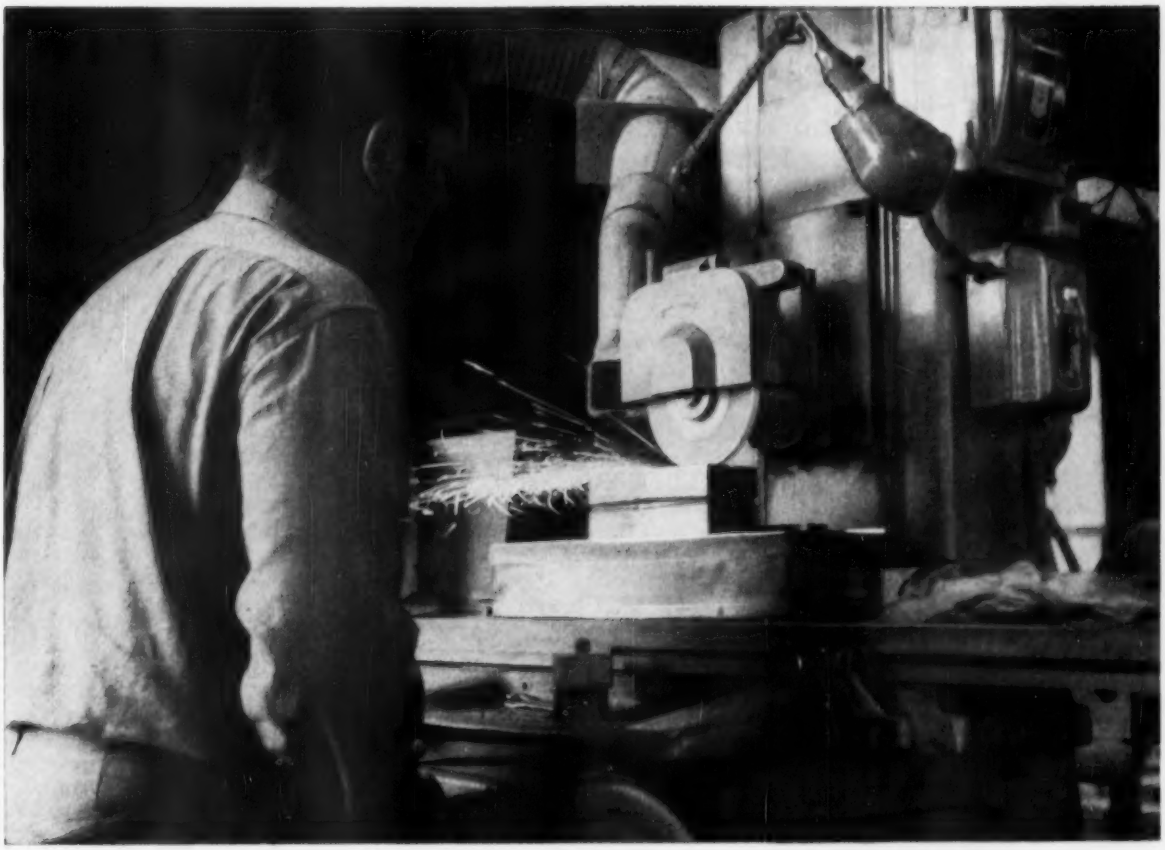
NEW SHOP EQUIPMENT

MICROMETER DEPTH GAGE with graduated base measures the depth of holes, slots, and projections. Base is graduated on one side to permit taking measurements at a specified distance from edge of work. Graduations are in 50ths (0.020 in.) and extend 2.4 in. both sides of zero. Unit is available in ranges of 3 and 6 in. with locknut or with locknut and ratchet—*Lufkin Rule Co, Saginaw, Mich*



PLAIN-ANGLE WHEEL DRESSER known as the Angle Master dresses with the diamond point horizontal to the center of the spindle. Unit is dustproof with sealed ball bearings used to provide long service. Meehanite base permits drilling and tapping of holes when needed for quick setups on cylindrical grinders—*J & S Tool Co, Inc, 87 Dorsa Ave, Livingston, NJ*

Wet dust collector for industrial use, the Ventrijet, mixes atomized water with the air stream to effect dust transfer. Dust-laden air enters the collector and expands in the inlet chamber at reduced velocity. Heavier particles sink to the bottom of the tank as sludge. Air is then drawn through one or more venturi tubes



"5 years ago Cities Service solved all our lubrication problems and we've never had another!"

A report from Banner Spring & 4 Slide Co., Van Dyke, Michigan

These Were The Problems 5 Years Ago: Banner Spring & 4 Slide Company, maker of small parts for the automobile, electrical and refrigeration industries, was having trouble. Ways, bearings, and drive shafts on 4 Slide machines were getting insufficient film strength from lubricants and constantly burning out. Likewise, compressors were also running hot, and there was complete puzzlement over what type of lubricant to use for Banner's high-speed sewing machines.

Banner decided to call in a Cities Service Lubrication Engineer. A thorough survey followed, with the man from Cities Service carefully examining each machine and its particular operating conditions.

This completed, he made his recommendations — Trojan H-2 Multi Purpose Grease for the 4 Slide machines, Pacemaker No. 1 Oil for the compressors, and Pacemaker 00 Oil for the high-speed sewing machines.

Banner followed these recommendations to the letter. **Result:** Not one lubrication problem in the past five years — despite the fact that machinery runs 24 hours a day!

If you're faced with a lubrication problem — or if you're just not sure if your present lubricant is best for the job — talk with the man from Cities Service. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

SOME BANNER PRODUCTS: The firm makes all kinds of round wire forms, wire springs, metal clips and flat springs. Use for such products ranges from auto fender support rods to "burlap listings"—the wire frames sewn into burlap which back up automobile upholstery.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

CUT EXPENSES

asg UNIVERSAL JOINTS are immediately available from stock

You can lower your operating costs with A.S.G. Universal Joints direct from your distributor. American Stock Gear Universal Joints are designed and built to the highest standards of quality and accuracy.

All A.S.G. Universal Joints are provided with self-locking retaining rings on the small pin. This simplifies assembly and disassembly. No rivet pins are used. They are available from stock in 13 sizes with bored or solid hubs ranging in diameter from .375" to 4.000". Special bores, bores with keyways or setscrews are available on special order.

Ask for Bulletin No. 527 describing the full line of A.S.G. Universal Joints.

AMERICAN STOCK GEAR DIVISION
Perfection Gear Company • Harvey, Ill. U.S.A.

into the discharge chamber. Low-pressure area in the venturi throat induces water also to enter the high-velocity air stream; the mixing of air and water causes the transfer of dust particles from the air to the water particles. Washed air then flows through an eliminator section for removal of droplets, and clean air is discharged. Collector is available in single- and double-row tube types, in a range of capacities from 1000 to 30,000 cfm.

Pangborn Corp, Hagerstown, Md

Duplex bearings assembly said to be completely self aligning is adaptable to both vertical and horizontal mounting and combines two sleeve bearing ball assemblies in a steel housing. Unit, as adapted for vertical mounting or thrust applications, is composed of a graphited flanged bearing with thrust collar and a regular graphited ball assembly. Pre-lubricated with Plastic Petroleum E, device is available in shaft sizes of ¾ and 1 in. For horizontal mounting, unit incorporates any of the variations of the company's "Deep-Well" ball assembly; users may specify either graphited or sintered bushings, with choice of pre-lubricated Plastic Petroleum E, oil, or grease lubrication. Range of shaft sizes is from ½ through 1 in.

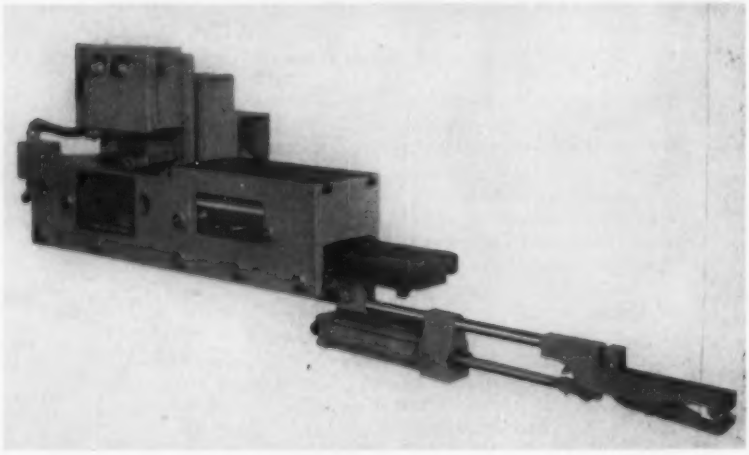
Randall Graphite Bearings, Inc, Greenlawn Ave, Lima, Ohio

Dynamometers, Torque Testers Accurate to ¼%

Type 300 are furnished in three models to test up to ¾-hp motors. Model 320 DY has capacity of 320 in. oz with a ¼-oz minimum reading. Units are claimed to be highly accurate and can test motors up to speeds of 10,000 rpm. Tachometers have an accuracy of 1%; various ranges can be furnished to specifications.

Dynamometers are housed in a case 22 in. wide by 28 high by 15 deep; torque dial is 10 in. in diameter. Torque measuring component is built around the Chatillon Iso-Elastic Springs which automatically compensate unit for temperature variations from 0 to 150 F. Hysteresis brakes apply a load to motor undergoing test, and dissipate heat developed. Details in bulletin P-711.

John Chatillon & Sons, 85 Cliff St, New York 38, NY

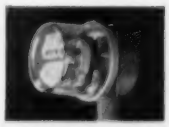


AUTOMATIC PRESS UNLOADER called Iron Hand is synchronized with press through limit switch and is operated by two air cylinders: main or lift cylinder and jaw cylinder for opening and closing jaws. When press signals that it is clear for unloading, jaw cylinder moves open jaw forward. At end of forward stroke, jaw grips part. At this point main cylinder retracts, lifts stamping out of die, and swings it clear of press. Jaw cylinder then retracts, unclamps part on table, and trips limit switch. Main cylinder then returns to normal waiting position. Unloaders are available in five standard sizes—*Sesco, Inc, 8881 Central Ave, Detroit 4, Mich*

MORE DIE CASTING - LESS SCRAP

New H-P-M Ups Production For Basic Aluminum Castings Co.

"By moving several jobs from a conventional toggle type machine to our new H-P-M, we reduced scrap loss to a minimum . . . at the same time we increased production." This report from T. M. Byrne, President, Basic Aluminum Castings Co. of Cleveland is typical. H-P-M die casting machines are doing an outstanding job for die casters throughout the country and here are the reasons why: They are designed to entirely new theories of metal injection and clamping. The new exclusive hydraulic-mechanical link-wedge clamp has plenty of "beef"—clamp locks die firmly to rated capacity and better. "Beef" limits die parting on overload during metal injection. Results—flash and scrap loss reduced to a minimum . . . quality parts produced to accurate dimensional tolerances. The new injection end has unlimited plunger motion control . . . exceptionally high speed. Call in an H-P-M engineer today and let him give you the complete facts before you buy. You'll be glad you did.



Watthour meter socket cast in a single cavity die on an H-P-M 400-ton die casting machine at Basic Aluminum Castings Co. This is a 1½ pound shot. Production—140 an hour.

DIE CASTING DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

HPM

Now! Closer gage block tolerances give you up to 75% longer wear life at no increase in price!

Ellstrom Standards are now produced and unconditionally guaranteed to specified millionths well within the following improved gage block tolerances:

"W" Working Accuracy Blocks: +.000008", −.000002" per inch of length, with flatness and parallelism held within .000006".

"I" Inspection Accuracy Blocks: +.000004", −.000002" per inch of length, with flatness and parallelism held within .000004".

In addition to providing finer accuracy at no increase in price, these Ellstrom Standards also give you up to 75% longer wear life. For, by reducing the allowable "minus" deviation, you get an additional guaranteed wear allowance of from 2 to 6 millionths of an inch, as compared to common industry standards, before the blocks need be considered worn undersize.

Ellstrom Standards are furnished in 28 basic sets of from 8 to 92 blocks in both rectangular and square styles. Individual blocks are also available in sizes ranging from .010" to and including 20.000" to meet your particular needs. Send for complete specifications and prices today!

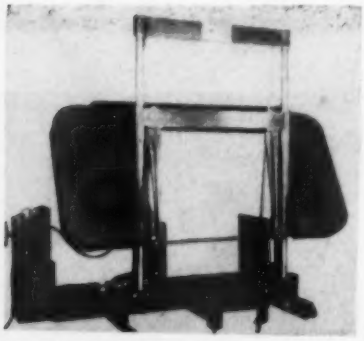
Set No. 35-R: "W"—$195.00; "I"—$280.50

Set No. 81-SA: "W"—$545.00; "I"—$784.35

ELLSTROM STANDARDS DIVISION
DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
22038 Beech Street • Dearborn, Michigan

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

- Ellstrom Internal Setting Gage—12" range: $185.00
- Ellstrom Rectangular Gage Block Accessory Set: $288.95
- Ellstrom Master Sine Bar "W" Accuracy: $112.50 "I" Accuracy: $152.75

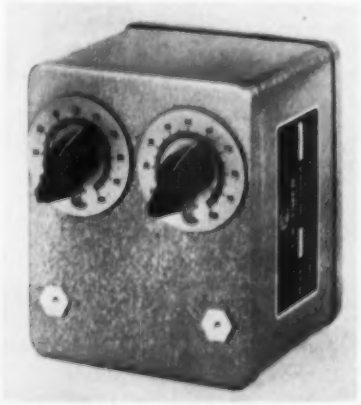


Metal Cutting Bandsaw Engineered to Specifications

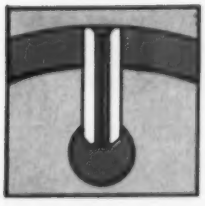
Special Model-J has cutting capacity of 38-in. rounds or squares. Height of bed from floor is 12 in.; over-all machine height is 8 ft 6 in.

A 3-hp motor drives the blade on 4 wheels at speeds of 2000, 1500, and 1000 fpm, suitable for cutting carbon, aluminum, magnesium, and brass. By specifying other speed ranges, unit is adaptable for cutting a variety of materials. Machine raises hydraulically on two posts. Push-button-controlled hydraulic pump unit and all electrical switches are enclosed by dust-proof control panel.

W F Wells & Sons, Three Rivers, Mich



RECYCLING ELECTRONIC TIMER, Model 3CK, is an enclosed unit with independently adjustable time ranges for both "on" and "off" cycles of 1.5, 3, 6, and 12 sec. Device can be converted to a single time-cycle operation by the removal of one tube from the unit. Other features: cold-cathode tubes require no warm-up time, tubes cut out during timed-out periods, assuring longer life; plug-in relays make for easy servicing. Unit is of 5 x 4¼ x 3¾-in. size—*Farmer Electric Products Co, Inc, 2300 Washington St, Newton Lower Falls, Mass*



TWO VANES ARE BETTER THAN ONE

The hydraulically counterbalanced DUAL-VANES in DUDCO Hydraulic Pumps eliminate wear producing loads normally caused by unbalanced hydraulic forces and vane acceleration. DUAL-VANES also maintain MULTIPLE SEALING BARRIERS to slippage and power loss. DUAL-VANES are a patented and exclusive DUDCO feature.

Member NFPA

CONTROLLED FLUID POWER Gives Your Machine Tools Greater *Flexibility*...

DUDCO PF-100 Series Double Pumps with combination relief and unloading valves provide high circuit flexibility through either automatic or external pilot control. For example... in a "hi-lo" circuit, large volume delivery is available for a fast traverse cycle. Then, during the feed cycle, when small volume is required, one pump section unloads automatically... saving dollars in horsepower! These pumps can also be operated on separate circuits... each circuit protected by its own relief valve.

DUDCO Pumps can operate *continuously* at 2000 psi. Their exclusive "Dual-Vane" feature and advanced design combine to assure long trouble-free performance and maximum simplicity in servicing. Thus, they are a natural choice for a wide variety of high production equipment, including: Machine Tools, Hydraulic Presses, Die Casting and Plastic Moulding Machines, Closing and Clamping Devices and other functions calling for controlled variation in Pump volume.

The PLUS factors in DUDCO Pumps weigh heavily at the sales end—so, WRITE... get the facts on DUDCO Dual-Vane Hydraulic Pumps and Fluid Motors.

KALAMAZOO DIVISION
THE NEW YORK AIR BRAKE COMPANY
9001 E. MICHIGAN • KALAMAZOO • MICH.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

SPECIAL MACHINERY BUILDERS FIND HYDRAULICS SPECIALISTS VALUABLE ALLIES

Independent Engineering Firms Assist With Custom Designs

A large part of the production equipment used in industry is specially built machinery or machine tools tailored to individual needs. Unlike stock equipment, these units are "one of a kind," built to perform specific functions. And, because such machines are not standard in any sense, the problems of securing components and making them work are important.

Fortunately for industry, there are today well established companies fully competent to assist with the design and engineering of the hydraulic circuits of such machines. They are also ready to supply and service the hydraulic components so vital to these machines. These distributors of Fluid Power equipment stock, sell, engineer and service every component for even the most complicated Fluid Power circuit. They can furnish anything from a single hose coupling to a complete Fluid Power application and make the installation if needed.

One well-known organization of this type, serving the New York Metropolitan area, is Nielsen Hydraulic Equipment, Inc., of Pelham Manor, New York. This company maintains a well stocked warehouse and provides a complete engineering service for its customers in varied industries.

The New England area is served by another important hydraulics specialist, The James H. Stewart Company. This organization carries in stock just about every Fluid Power component that a machine builder could use. It can furnish engineering assistance to almost any extent, too.

Both of these companies stock a complete line of HYDRECO and DUDCO Fluid Power equipment.

They have no affiliation with the manufacturers of the products they sell. They are owned and operated by independent businessmen who understand the problems of the independent businesses they serve.

KALAMAZOO DIVISION
The New York Air Brake Company
9001-8 E. Michigan
Kalamazoo, Michigan
Gentlemen:
I would like more information about the DUDCO PF-100 Series Double Pumps with Valve Panels. Please send me Bulletin DP-308.

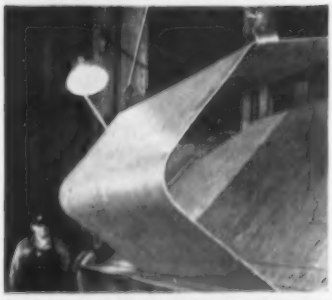
Name_____
Company_____
Address_____
City_____ Zone_____ State_____

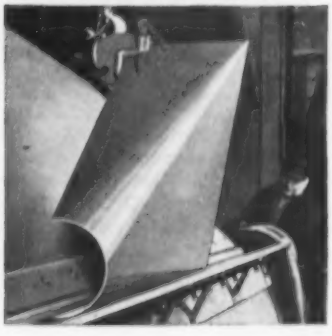
Bending Steel Plates for WELDMENTS?

do it economically with

CHICAGO® POWER BENDING BRAKE

(no dies needed)



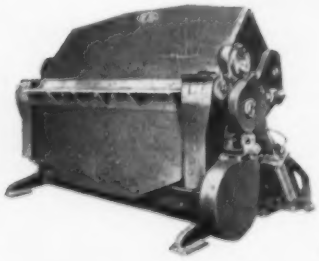


The accompanying illustrations give an idea of the versatility of the CHICAGO bending brake. No dies have to be changed or adjusted—no dies are used on these jobs. Yet, duplication is easily obtained on successive pieces. The machine is quickly adjustable for different thicknesses of material up to rated capacity. Automatic stop regulates the angle of bend. This, too, is adjustable to any degree of bend. The ease of changing from one job to another and the elimination of die costs make the CHICAGO bending brake the economical method for bending steel plates for weldments.

Many standard sizes are available with capacities for bending mild steel up to 12 feet by ¼ inch or 16 feet by ½ inch. Also many standard sizes in hand and power operated models for sheet metal.

BULLETIN P-55
This bulletin gives the details of how these and many other jobs are handled. Also complete description of the machine and specifications of the standard sizes.
Ask for a copy.

Front view of one of the heavy duty models of CHICAGO power bending brake showing the operation end of the machine.



Recommendations for any job on request.

6473

CHICAGO DREIS & KRUMP

Press Brakes • Straight-Side Presses • Press Brake Dies

Hand and Power Brakes • Special Metal-Forming Machines

DREIS & KRUMP
MANUFACTURING CO.

7434 South Loomis Boulevard, Chicago 36, Illinois

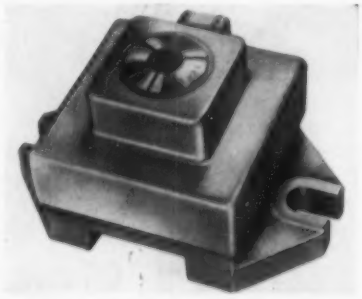
NEW SHOP EQUIPMENT

Lightweight Electrode Holder

AL-300 Twecotong for arc welding has body and upper lever made of high conductivity aluminum forgings. Unit weighs 13½ oz, said to be a 50% weight reduction over copper castings.

Upper and lower replaceable jaws are cadmium-plated copper. Price, $6.90.

Tweco Products Co, PO Box 666, Wichita 1, Kan



AIR-OPERATED COLLET FIXTURE known as Air-Pal is said to simplify secondary-operation work on parts that can be chucked in a standard 5C 1-in.-max-dia collet. Larger-diameter step collets can be used for special applications. Collet provides positive two-way power and has a 750-lb pull at 100-lb air pressure. 4-lb device measures 3½ by 4 by 6½ in.—*Beckett-Harcum Co, Wilmington, Ohio*

Air Cylinder Automation Package

Renco-Aire cylinder incorporates an air-operated micro-action directional valve and adjustable 2-way speed controls with fully adjustable hydraulic check. Cylinder is available in any desired stroke. Unit, requiring only a single air connection, is furnished in various mountings for immediate machine tool conversion to full or semi-automatic operation.

Valve operates on pressures as low as 1 psi with full automatic action, is adapable for low or high pressure operation. It will operate at over 3000 cycles per minute; built-in stroke adjustment can be controlled to ± 0.001 in.

Renco-Toledo, Inc, Dept AM-1, 819 N Reynolds Rd, Toledo 7, Ohio

Webber Aluminum Rivet Cooler Has Mechanical Locking Device

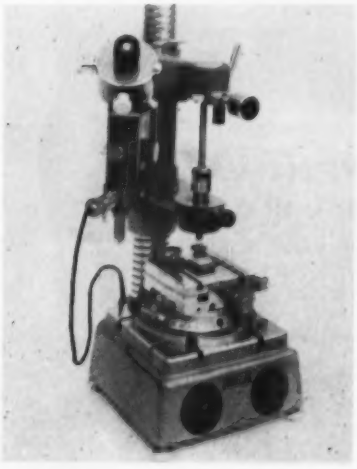
Featuring a non-electrical mechanical locking device operating over a temperature range of from ambient to –40 F, aluminum rivet cooler is compactly designed, with outside dimensions of 33½ in. long, 23¼ in. wide and 39⅜ in high. Usable space inside measures 27 x 13 x 11½ in.

Safety locking device has a special feature so designed that if temperature should rise to –20 F, the lid is automatically locked, thus preventing use of aluminum rivets which have been exposed to warmer temperatures, which increase their brittleness and the risk of interior heading.

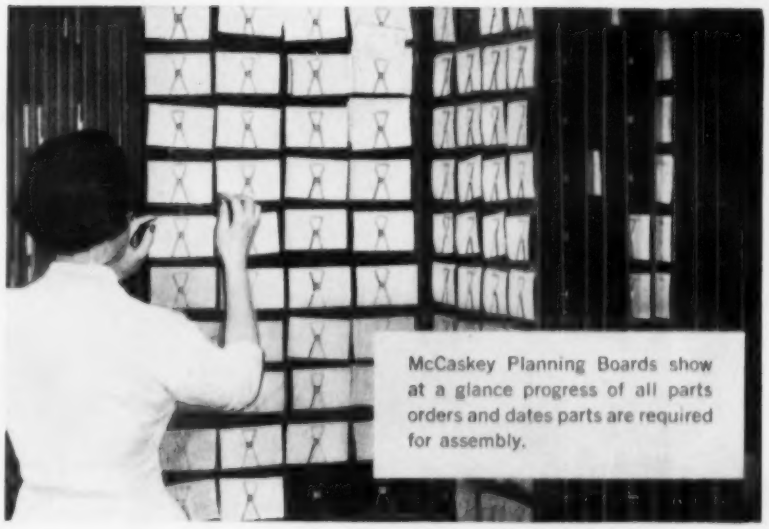
Unit is equipped with a temperature control which has a range of from 0 to –50 F within ± 2° of accuracy. Standard equipment also includes a temperature indicator with range of from 120 F to –50 F.

Unit features top-opening lids, actuated with a foot treadle to open a minimum of 75°. Canisters supplied with cooler are 2 in. in diameter and 7 in. high. Each machine holds 50 canisters. Refrigerant used is Freon.

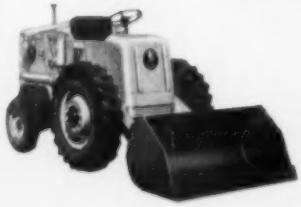
Webber Engineering Corp, Dept ARC-287, PO Box 217, Indianapolis 6



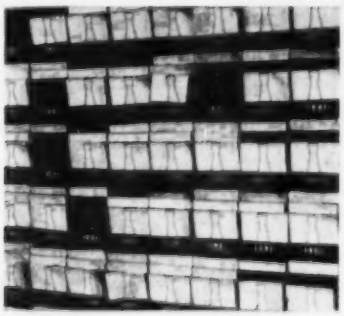
INTERNAL LIMIT GAGE made by Karl Frank of Weinheim-Birkenau, West Germany, is made of a metal so hard that it is reported to increase durability of gage more than fifty times that of steel. Although cost of hard-metal gages is higher than steel ones, expenses are greatly reduced. Gages are said to have unusually high resistance to wear, together with long-lasting accuracy and high precision—*Imported by Testing Machines, 123 W 64th St, New York 23, NY*



McCaskey Scheduling and Production Control Pay Off For "Payloader"



Single form system saves costly man-hours and eliminates delays for The Frank G. Hough Co.



McCaskey machine loading and assignment boards schedule parts orders for machines and subassemblies.

McCaskey Planning Boards and Machine Control Boards—with *multiple copies of a single form*—prove effective for The Frank G. Hough Co. of Libertyville, Ill. during its present period of rapid expansion and increased employment.

Here are just a few of the ways McCaskey Scheduling and Production Control pay off for "Payloader"—how they can pay off for you:

(1.) Provide visible records of all jobs or parts orders and necessary completion dates.

(2.) Progress of parts orders is seen at a glance.

(3.) You can quickly review the status of every job in the plant and locate those that might upset schedule.

(4.) No delays because—Machine loading and scheduling of subassemblies proceed as specified by the production control department.

McCASKEY INDUSTRIAL CONTROLS
Production • Inventory • Tools • Maintenance • Costs
Division of
VICTOR ADDING MACHINE CO.
3900 N. ROCKWELL STREET • CHICAGO 18, ILLINOIS

VICTOR-McCASKEY LIMITED,
GALT, ONTARIO

Manufacturers of Business Machines
Cash Registers, Business and Industrial Systems, Electronic Equipment, Electri-Cars.

Mail Coupon For Complete Information

Victor Adding Machine Co.
McCASKEY INDUSTRIAL DIVISION,
3900 North Rockwell Street
Chicago 18, Illinois

Please send me complete facts on: McCaskey Machine Loading and Production Control System.

Name_____

Position_____

Company_____

Address_____

AM-856

There's more in this barrel for you...

MORE MACHINE BUILDERS' APPROVALS
to help improve production and lower unit costs

Specify Socony Mobil—and you get petroleum products approved by more machine builders than those of any other oil company. And no wonder. Our engineers have always worked closely with designers and builders. They advise on hydraulic and lubrication system design . . . suggest *correct* products for each machine—to help improve your production, lower unit costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* services for analyzing petroleum products in use . . . *more* on-the-job training of your personnel in correct product application . . . *more* continuous research to assure continually improved products . . . *more* practical experience—90 years!

* * *

Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY
SOCONY MOBIL

FIRST STEP
IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

Bliss Automation Limit Switch In 9- or 4-Station Units

Nine-point mechanical rotary limit switch, designed to automate a wide variety of machine operations or sequences, can operate at various speeds, but is said to be especially useful in the control of fairly rapid operations requiring split-second timing.

Each of the nine control stations on the face can be independently set through the complete range of zero to 360° by means of its own calibrated micrometer dial and stem arrangement. Individual switches are thrown off and on by a single rotating helical cam. Each station can be preset to within 1°, and final micro-adjustment reduces this error to less than ¼° of arc. Two models are available—a 9-station and a 4-station for simpler applications.

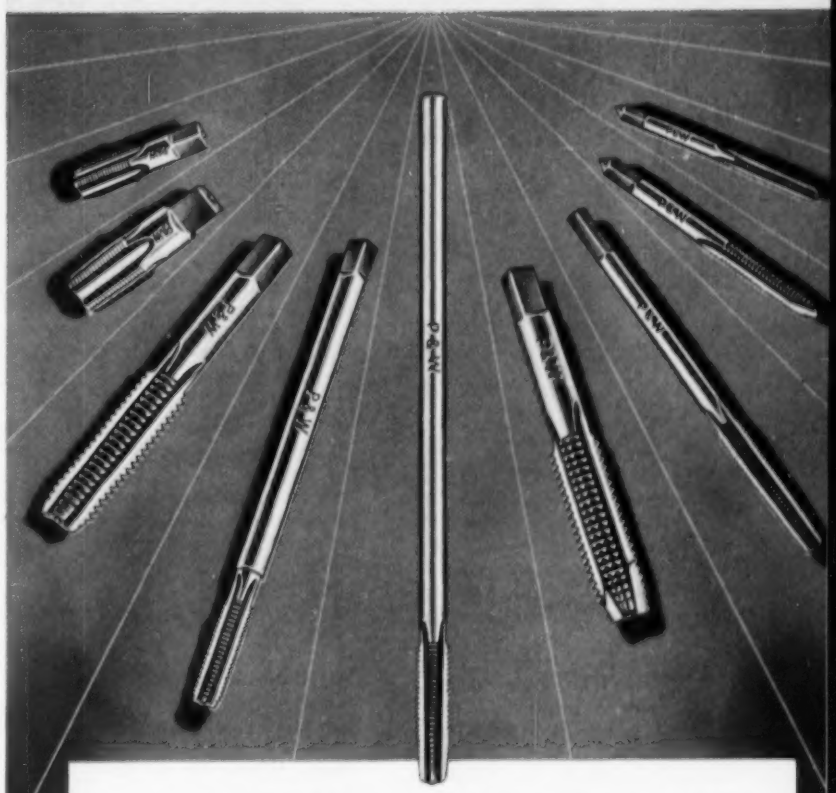
E W Bliss Co, Canton 10, Ohio

MEASURING INSTRUMENT, called Contour-O-Scope, checks and inspects dimensional radial accuracy of contoured surfaces. Device eliminates need for intricate setups and layouts, provides direct readings, is said to be extremely accurate, and easy to operate—*Summit-Roberts Products, Inc, 830 New York Ave, Toledo, Ohio*

PRATT & WHITNEY

Quality TAPS

for the long run . . .
because they run longer!



Next time you're figuring tooling costs, remember it's not the purchase price that's most important. It's what you get for your money . . . the number of clean, accurate threaded holes each tap delivers on the production line!

Correctly designed, carefully manufactured and rigidly inspected, *every* Pratt & Whitney Tap you buy has the same high quality. There is a complete line for all your needs . . . available from on-the-shelf stock at Pratt & Whitney Branches everywhere.

Write now for P&W Ground Thread Tap Circular No. T-583 and Cut Thread Tap Circular No. 541.

PRATT & WHITNEY COMPANY
INCORPORATED

11 Charter Oak Boulevard, West Hartford 1, Connecticut
Branch Offices and Stock in Principal Cities

MACHINE TOOLS • GAGES • CUTTING TOOLS

Finding the
ROTTEN APPLE *in the* **BARREL**

William O Dunn

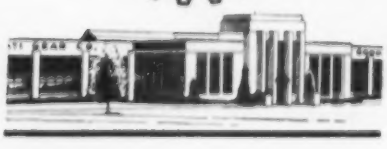
CHIEF INSPECTOR, THE CINCINNATI GEAR CO.

Several years ago we ran an ad entitled "Ears for Gears" that produced a lot of comment. The unusual title was explained in the copy, in which we told how we can individually *sound check* gears for minimum noise level. This checking is done on ultra-modern testing equipment, under specified load and R.P.M., measuring the decibel tolerances of the individual gears. Not only does this help us produce silent-running gears, but it is also one example of the extensive checking and testing to which we subject our gears, to be *sure* of maintaining our reputation for delivering only *good* gears.

This checking and testing, which is the responsibility of my department, is one of the most important functions in our plant. It's always *possible* for a "rotten apple" to slip into the barrel, but it's *essential* that it be found and removed before shipping. That's why my department can't afford to make any mistakes, or compromise in any way. Top management realizes this; they provide us with the best available equipment, and I report directly to our President (eliminating any possibility of "shop influences" in our testing standards). As a result, our customers have the assurance that when they send us an order they'll receive only the best custom gears obtainable.

THE CINCINNATI GEAR CO.
CINCINNATI 27, OHIO
"Gears—Good Gears Only"

CINTI



NEW SHOP EQUIPMENT

Dillon Force Gage Makes 50,000-lb Tests

Available for either compressive or tensile tests, 50,000-lb force gage has warranted accuracy of within 1% of indicated reading. Tensile version is illustrated, with eyes for the insertion of clevises. Compression model has a recessed cup on top for seating a free-riding steel ball; rotating action of ball under pressure insures true vertical thrust against gage.

Safety stop-bolt at upper right of tensile model prevents undue expansion of open end of gage. Microswitch feature is optional and will control a wide variety of electrical operations.

W C Dillon & Co, 13620 Keswick St, Van Nuys, Calif

Oyltite-Stik for sealing oil leaks can be used on hot pipes where pressures up to 75 psi and temperatures up to 400 F are encountered, according to manufacturer. Seals cracks, pinholes, etc, in tanks, pipes and containers of all kinds; can be applied while oil is flowing.

Lake Chemical Co, 3052 W Carroll Ave, Chicago 12, Ill

Dial indicator, Model 21019, has been added to Petz-Emery line of 24 models. Device will give accurate readings to within 0.00001 in., is graduated in 50-millionths over a measuring range of 0.002 in. Bezel size is 2¼ in. Company's Em-Re shockproof system protects jeweled movements.

Petz-Emery, Inc, Pleasant Valley, NY

Spherical Corners, furnished in metal thicknesses from ⅛ to ½ in., can be welded into place on weldments with round edges, such as machine tables, housings, drip pans.

Conner Steel Products, 2690 Telegraph Rd, Detroit 19, Mich

O-rings (MS28784) made from compound SR818-70 are suitable for use in Air Force and Navy aircraft hydraulic systems and general industrial hydraulic service. Operating temperatures range up to 275 F with IDs from ⅛ up to 15½ in. for moving or non-moving seals.

Stillman Rubber Co, 5813 Marylin Ave, Culver City, Calif

Air volume booster, Series 2000, has ⅜-in.-dia supply and exhaust seats. It will reportedly fill a 24-in. valve motor to 15 psi in less than one second with a 100 psi supply, will exhaust to 3 psi in three seconds. Available in a 1:1 ratio only, with ¼-in. NPT tappings standard, ⅜ in. on special order.

Bellofram Corp, Governaire Division, Burlington, Mass

Precision-ground dowel pins, Type D2, are available from stock in basic diameters 1/32, 1/16, 3/32, and ⅛ in., in lengths from 3/32 to ⅞ in., held to precision tolerance within ± 0.0001 on the dia. Material is No. 303 stainless. Catalog No. 7.

PIC Design Corp, 160 Atlantic Ave, Lynbrook, LI, NY

Midget soldering iron with ⅛-in. tip weighs only an ounce, is no larger than a pencil. Device contains company's "Thermostatic Brain," which provides thermostatic action to control heat so that fusing and tip-burning are eliminated. Iron is 7½ in. long, operates on 110-120 v ac or dc. Handle is kept cool with special "chimney" feature.

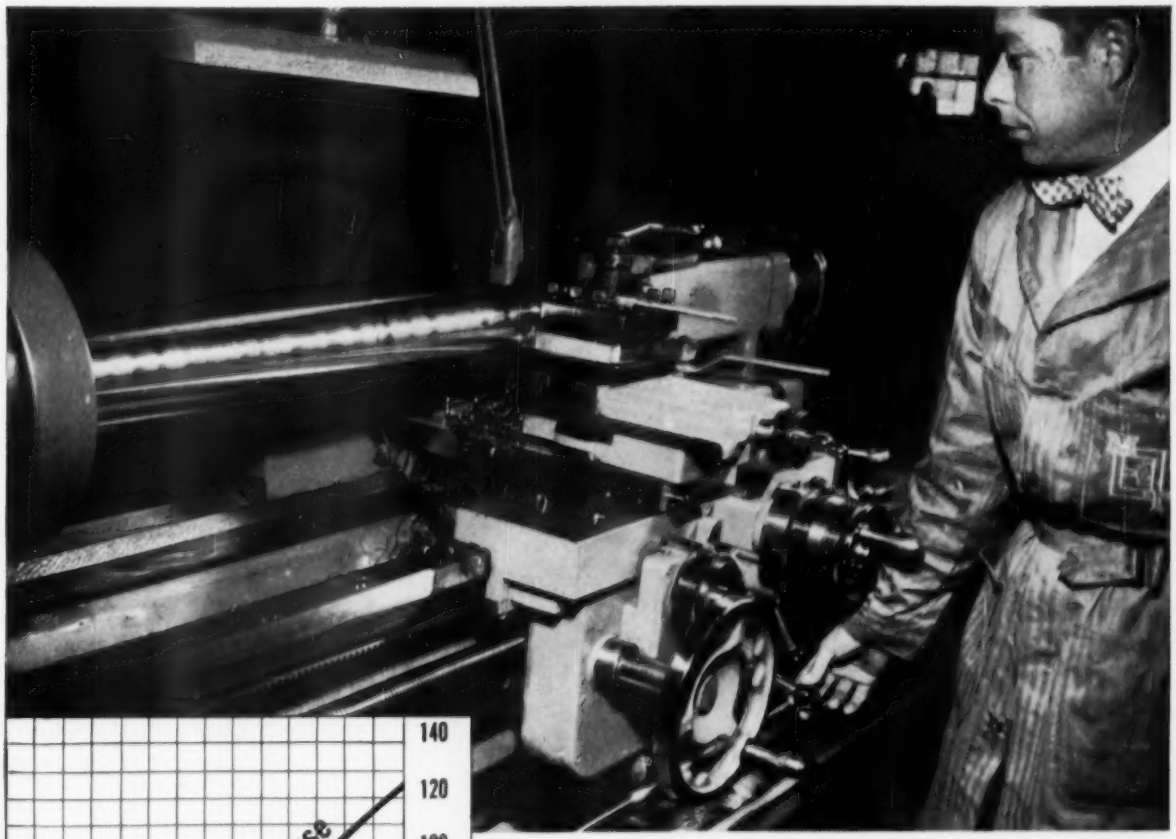
Wall Mfg Co, Grove City, Penna

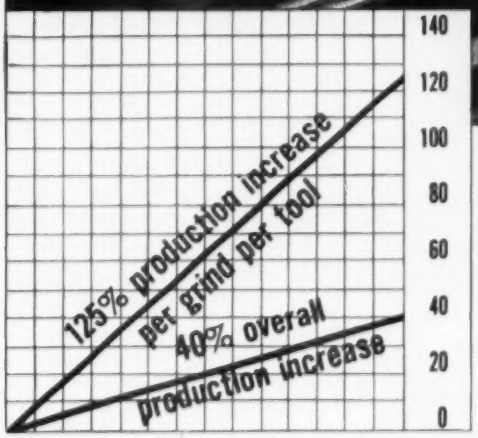
Lithium metal is available in commercial quantities, offered in 1-lb ingots packed under oil in sealed steel cans. Each can typically analyzes 99.8% lithium. Applications in metalworking industry include use as an alloy for non-ferrous metals and as a scavenger and degassifier in ferrous and non-ferrous fields.

Foote Mineral Co, Exton, Penna

Bondized sheets of Kelon-F, specially treated on one or both sides, allow bonding to a variety of materials or to themselves using commercially available adhesives. Bondized film and sheets are said to be especially adaptable for parts encountering wear or corrosive conditions. Bondized Califilm is available in thicknesses from 0.005 to 0.015 in., in widths up to 16 in. Kelon-F sheets are furnished in thicknesses from 0.015 to 0.250 in.

Shamban Engineering Co, 11617 W Jefferson Blvd, Culver City, Calif





Lathe Shaft production *UP 40%* with new Firthite TXH Carbide

Wherever used, *new* FIRTHITE TXH Carbide is proving its competitive superiority . . . as at Boyé & Emmes Machine Tool Company, Cincinnati, for turning lathe shafts from 3 inch SAE 4140 un-annealed steel.

Here's what they found:

- Overall production went up 40%.
- Production increase of 125% per grind per tool.
- Twelve shafts per tool without regrinding.
- Only .0010 flank wear in 12 cuts.

Impressive? You bet! So much so that many tool engineers have acclaimed TXH as the most nearly "universal" grade of carbide yet developed. That's because TXH is an entirely new concept in carbide metallurgy . . . a combination of materials and processes designed specifically to do heavy-duty, high-production cutting operations better than they have ever been done before. And while a distinctly *premium grade,* TXH is not *premium priced!*

You try it. It's available from stock in all standard tips, tools and inserts.

TXH ADVANTAGES

- Higher hardness to strength ratio
- Improved impact resistance
- Wider range of applications
- Lower operating temperatures
- Higher edge strength
- Greater resistance to abrasion

N-317

Firth Sterling

—INC—

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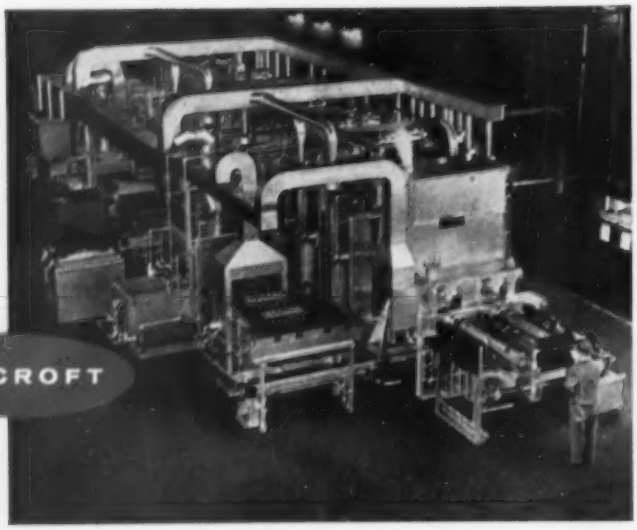
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

BLAZING THE HEAT TREAT TRAIL— WITH HOLCROFT



LET'S TALK

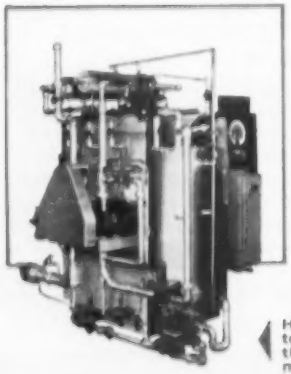
CONTROLLED ATMOSPHERES

Holcroft has pegged many of its research activities to the problems of controlled atmosphere heat treating. As a result, Holcroft has blazed the trail for industry.

Controlled atmospheres protect the stock while it is being treated and help produce the desired finish to the parts. Scale and decarburization are eliminated. Stock in the furnace chamber is surrounded by a gas atmosphere which excludes all air and products of combustion.

Basic gas generator patents go back to 1883. However, the first real use and understanding of fundamental equilibrium constants—now in general use in all gas atmosphere work—was by Holcroft in 1934. Dew point cups and equilibrium curves were furnished customers at that time. Today, Holcroft's new Lo-Dew generator (750, 1200 and 2400 cfh) provides *rated capacities* at low dew points.

Advances like these are typical of the scope of Holcroft activities—proof that you can get right answers without prejudice. Insist upon a Holcroft quotation as your first step when you have a heat treat problem. *You'll save!*



Holcroft's new gas generator designed to produce gas atmospheres between the limits of perfect combustion and modified "302".

HOLCROFT AND COMPANY

6545 EPWORTH BOULEVARD • DETROIT 10, MICHIGAN

PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • DARIEN, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILADELPHIA, PA.

CANADA: Walker Metal Products, Ltd., Windsor, Ontario

ROUND TABLE Discussion

AUTOMATION BLUES

Is automation actually a threat to a worker's job security? Should it be looked on as a system which will eventually replace today's worker, or as a technique that will multiply jobs in other fields?

WHEN I FIRST started working I would hear gripes about automatic machinery and mechanization. The cry then, as it is now, was it would put people out of work. Yet we continue to employ more people each year. Recent figures show more people working than ever before in history.

Automation is simply a shorter name for mechanization. Automation makes it possible to increase the output with less employees, but it also creates other jobs; automation makes it possible to discover new industries. It will also make it possible to pay better wages with shorter hours. With a bigger cut of the profits of the organization, the employees will spend more. We are developing new industries every day.

As for new developments, we have not seen anything yet. We are the richest country in the world as well as the most powerful. Yet in many respects we are not too far ahead of Russia, Germany, Italy or Japan. We must maintain our advantage and go forward in any way that will increase the output. Our standards of living must continue to rise. I feel sure that business and labor have learned that they must depend on each other. Providing the things people want for a price they can afford to pay will keep us prosperous.

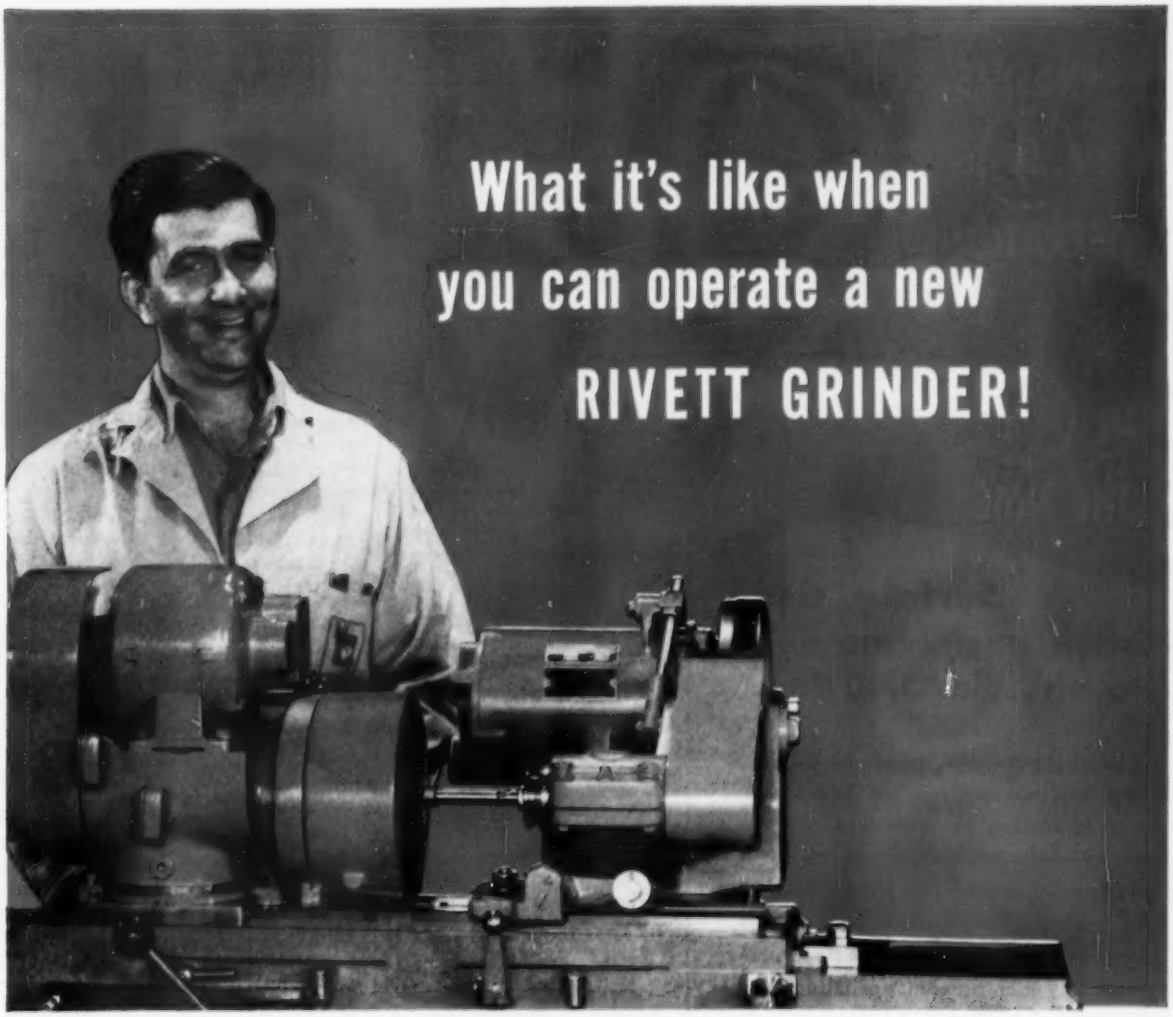
A E Salmons
Norristown, Penna

•

GRIND OR GALLOP?

Will making an apprenticeship course more attractive in terms of pay and promises draw more candidates? Or will keeping the course tough weed out the half-hearted and unsuited?

WHEN I was serving my apprenticeship, I signed a contract with the company whereby I was to receive automatic increases every six months. In the four years a small percentage of my wages was to be withheld by the company to accumulate a $500 bonus for completing



a big smile for operators — a big smile for management because both benefit by —

1. Greater output **2.** Closer tolerances

3. Reduced set-up time **4.** Minimum rejects

Get proof of greater productivity with Rivett Internal Grinders

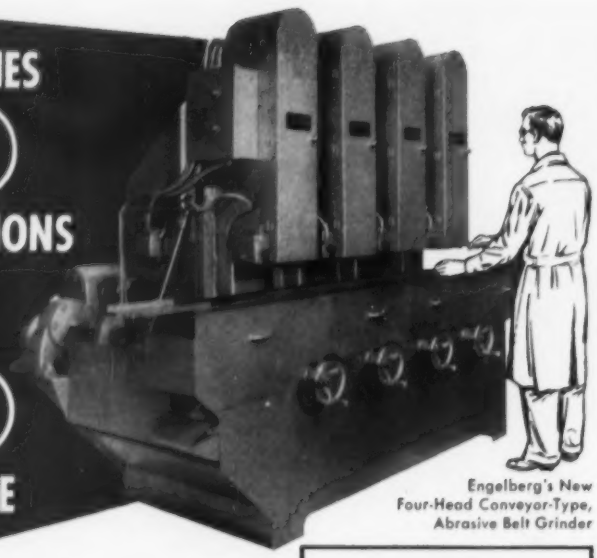
Write for Catalogs and prices today— showing Model 84 with 3" capacity and Model 1024 with 9" capacity

A symbol of accuracy in machine Tools.

RIVETT

LATHE & GRINDER, INC.
Dept. AMR-8, Brighton 35, Boston, Mass.

FINISHES 4 OPERATIONS IN 1/4 THE TIME



Engelberg's New Four-Head Conveyor-Type, Abrasive Belt Grinder

Surface, size, Semi-finish, Fine Polish... in ONE Pass!

Talk about high speed production. You will — when you see Engelberg's new multi-head conveyor-type abrasive belt grinder precision size and fine finish *any* ferrous, non-ferrous, plastic or other flat surface. *With one machine — one operator — and one pass* — you can now complete *four* different grinding and polishing operations.

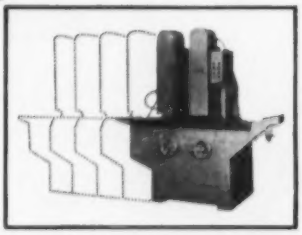
Think of the costs you can slash on high-volume runs. Think of the time you can save on set-ups and changeover. And the initial cost is far less than you'd have to pay for separate machines.

SEND SAMPLE PART TODAY for cost-and-time-savings estimate. Or if more convenient, an Engelberg Production Engineer will be glad to discuss your grinding problems. No charge — no obligation, of course.

ENGELBERG

HULLER CO., INC.

188 Seneca St. Syracuse, New York



Choice of 1 through 6 grinding heads with 6", 8", 10" or 12" belt width.

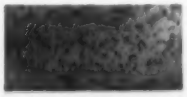
Parts Finished in ONE Pass

Chain Saw Bars — 4 head operation removing .004" per head for total .016" per pass.

Roger Dean FORD

Name Plate — 3 head operation using #240, #320 and #500 grit abrasive belts with conveyor belt speed of 14' per min.

Skate Blades — 5 head operation using #120, #180, #240, #320 and #500 grit abrasive belts at 12' per min. conveyor belt speed.



Rubber Tile — 3 head operation using #240, #400 and #600 grit abrasive belts with conveyor belt speed of 21' per min.

the course. If I decided to leave before the end of four years, I would forfeit any accumulation of money during the period.

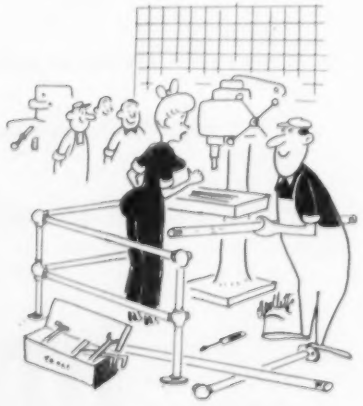
The increases at the end of four years would bring my rate slightly below the standard journeyman's. At this time I would be offered a position with the company at a journeyman's starting rate. In most cases I could obtain a better rate with another company which did not have apprentice courses.

There were always times when the company did not have openings in their shop and the apprentices had to find jobs on the outside. This was not too great an effort since many companies without apprentice courses had bids in for the surplus men.

It was discouraging at times to run across friends who never finished their courses and were making more money. It was even more discouraging to realize that production personnel without any training were paid a higher rate.

The final reward was to complete the course and classify yourself as a machinist. After a couple of years at the game you soon realize that your rate of pay is not much more than the production machine operators and you wonder if it was worth the trouble. If you entered the field with the intentions of making large sums of money, then it was a waste of time. If you were intrigued by the type of work and were happy doing it then it was well worth the time and effort. The hot-shot overpaid man does not work steady because he is never satisfied. The work is monotonous or difficult since he has no interest in it or he hasn't been properly trained.

Watch an expert juggler sometime



"You don't have to put guard rails around me mister. If anyone gets fresh with me, I'll call my husband in the toolroom."

MICRO *precision switches*

...THEIR USE IS A PRINCIPLE OF GOOD DESIGN

Precision, 2-circuit switching unit is enclosed in rugged aluminum housing. Compact design meets small-space requirements.

Flush-mounted design which may be recessed into a cavity in the machine. Mounted on cover plate. Operating characteristics of both switches are identical.

Here is a small, 2-circuit limit switch to meet a wide variety of machine tool applications

This MICRO precision switch is designed to meet every requirement for a compact 2-circuit switch for use as a limit, safety or interlock switch on complex production equipment.

It has small size, extreme versatility, precision, reliability and ruggedness. All moving parts and the switching chamber are completely sealed, protected from wear or becoming fouled. Versatile field adjustability permits its use in practically any type of application or location.

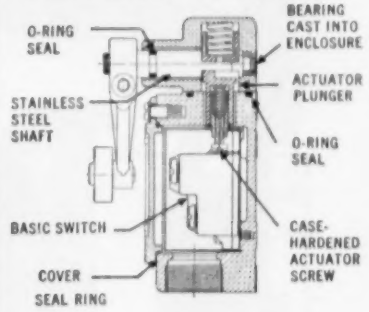
Two-circuit contact arrangement allows flexibility in circuit design. Reliability of the precision, snap-action unit assures accurate repeat operations throughout many millions of hard, fast actuations. Although small and compact in size, this switch is not only a precision instrument. It is designed and built to stand the most severe abuse.

The electrical rating is: 10 amperes 120, 240 or 480 volts a-c; ½ H.P. 115 volts a-c; 1 H.P. 230 volts a-c; .2 ampere 115 volts d-c; .1 ampere 230 volts d-c; .04 ampere 550 volts d-c. Pilot duty rating is: 600 volts a-c, max.

Like many other precision switches in the MICRO SWITCH line, this versatile 2-circuit switch is also an ideal component for installation on present plant equipment. MICRO precision switches make production machinery safer, more automatic and more productive.

As shown above, this switch is also available in a flush-mounted design which may be recessed into a cavity in the machine. The operating characteristics of both switches are identical.

Seals Provide Maximum Protection



Sealing is provided by use of O-ring seals on the actuator shaft and between the actuator head and the housing. A synthetic rubber ring seal is provided for the cover. These seals provide maximum protection against entrance of dust, oil and other liquids. The switch meets NEMA specifications for an oil-tight pilot device.

Adjustable Head Assembly

The switch is easily mounted in almost any location. The user can remove the head and locate it in any of 4 positions (as illustrated). The actuator arm is field adjustable to any position through 360° and can be adjusted to operate in either direction or in both directions.

Contact Arrangement

Contact arrangement of the basic switching unit is double-throw, two-circuit, single-pole, double-break. A single-pole, double-throw circuit can be obtained by tying together one normally-open and one normally-closed terminal and using this connection as the common terminal.

MICRO precision switches are sold by distributors in key cities everywhere. For engineering assistance, call the MICRO SWITCH branch nearest you.

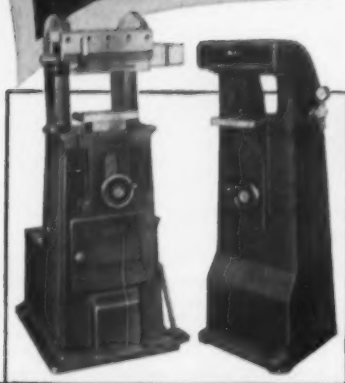
MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario • FREEPORT, ILLINOIS

HOW TO KNOW ALL THE ANSWERS . . .

WHEN THE QUESTION IS *Marking!*

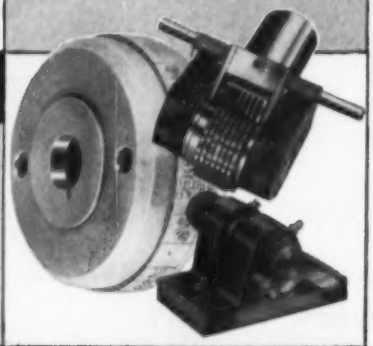


MARKING
MACHINERY

Production efficiency and economy is assured with Parker recommended, Parker built marking machines—standard or custom.

MARKING
TOOLING

Parker marking specialists will suggest, develop, deliver the tooling and fixtures your job and equipment demands to keep production up, costs down.



MARKING
METHODS

The Parker design and engineering staff stands ready to make your "impossible" marking applications routine, routine applications far more efficient.

When marking speed . . . adaptability . . . precision . . . legibility . . . or economy is a problem, Parker has the answer. Let Parker put a marking expert in your plant, let 85 years of marking experience help YOU. Send information on your marking equipment needs for prompt advice—ask for the helpful Parker catalog, too.

THE PARKER STAMP WORKS, INC.
MARKING DIE & MACHINERY DIV.
FRANKLIN AVENUE • HARTFORD, CONNECTICUT

by Parker

and notice how at ease he seems. Notice, too, how he enjoys himself while he amuses the audience. A well-trained mechanic has confidence, enjoys a good day's work and is not like an inexperienced juggler, who is flustered and uncomfortable and anxious to run off the stage.

Frank J Zarnowski
Rutherford, N J

The company cannot be expected to pay apprentices attractive wages in order to insure having them complete their training. The apprentice is not under any obligation to remain with the company upon the completion of the training period; therefore the company has no way to protect any investment that it makes in the form of money spent to train apprentices.

When the company hires machine operators, production workers, or even porters, it is fully aware of the facts. They know that a short training period will be necessary during which time the new employee's output will be very low. At the same time he will require instruction and lose supervision. If the new man quits after a week or two the company has suffered a loss for the cost of the paper work attached to this operation, training and supervising him, paying for spoiled work and wasted material, and paying him his wages. In return they have perhaps received some small amount of production. This is the accepted procedure and the company must follow it because there just isn't any way around it. The best they can do is to exercise care in selecting new employees. When it comes to toolmaking apprentices the company just cannot be expected to foot the bill for three or four years.

As a general rule employment opportunities must compete against each other for men. It is unreasonable to expect such an unbalanced condition that one field would present opportunities far superior to other fields.

It is my belief that the ultimate goal should be the object of major consideration to anyone selecting a field of endeavor for his life's work. There are many fields where trainees do not receive any compensation at all. The engineering student in college, or the hopeful scholar in medical school are in training and are paying for their instruction. The medical student must follow his period of study with an internship at very low pay.

There are certain advantages to making it difficult to become a tool-

carbide NEWS

WESSON Multicuts send tool costs tumbling from 42 cents to 1 cent per piece

Tools Developed for High Output Pay Off on Low Volume Jobs

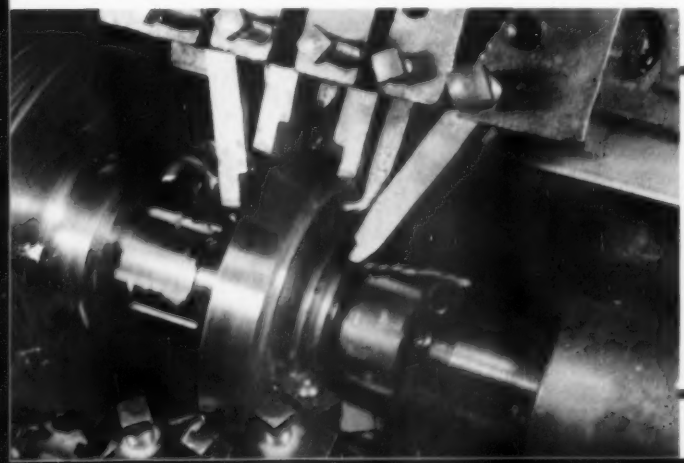
Sharply reduced tool costs and a 30 percent increase in production were the direct results of changing from conventional tooling to indexible insert carbide tooling at the plant of a mobile materials handling equipment builder. Thus the application of tools developed originally for volume production also paid off in producing parts at a relatively low output rate.

The job consisted of machining a cast steel hoist drum on a Bullard at a rate of 1.27 pieces per hour. The former tool cost of 47 cents per piece for facing and turning the flange, rough facing and turning the drum hub and finish facing and turning the hub was slashed to 1 cent as the result of a change to Wesson Multicut holders and Wessonmetal indexible carbide inserts.

Most of the former high tool cost was due to the fact that only 4 pieces per grind were obtained in machining the flange and roughing the hub. Currently the Wessonmetal WM inserts turn out 80 pieces per grind. Similarly the number of pieces in finishing the drum hub has gone up from 10 pieces per grind with the brazed tool formerly used to 120 pieces per grind with Wessonmetal WH.

Additional savings result from an 85 per cent reduction in down time for each tool change with the end result being a 30 per cent improvement in output.

Special note should be taken of the fact that these savings were achieved without resorting to special carbide grades. Both Wessonmetal WM and WH are strictly standard.



Here's a case where "equivalent" carbides, at least in the "Classification Code", gave considerably different performances. The job is rough and finish turning multiple diameters of 4021 steel forgings in an eastern gear plant. Tool life jumped from 180 to 750 pieces per grind when Wessonmetal WH (a C-7 grade) replaced the C-7 grade previously used. Tool costs dropped from 2 cents per piece to half a mill and production increased because of lower down time. The reason? Grade WH effectively resisted cratering where the other hadn't.

carbide NEWS

Boring Tool Features Throw-Away Insert

Among the increasing number of boring cutters developed by Wesson to take advantage of the throw-away insert concept is a special cutter now being used to form an internal spherical radius on an automotive differential case to close tolerances.

As in most throw-away insert boring tool designs pioneered by Wesson, a number of exacting requirements had to be met before the design was accepted and the tool placed in service. Aside from the savings in setup time and the elimination of carbide grinding, the throw-away boring tool is holding extremely close limits on the radius to within plus .001-inch. Even closer tolerances are necessarily held on the insert and holder itself.

Special boring cutter developed by Wesson forms internal spherical radius on automotive differential case.

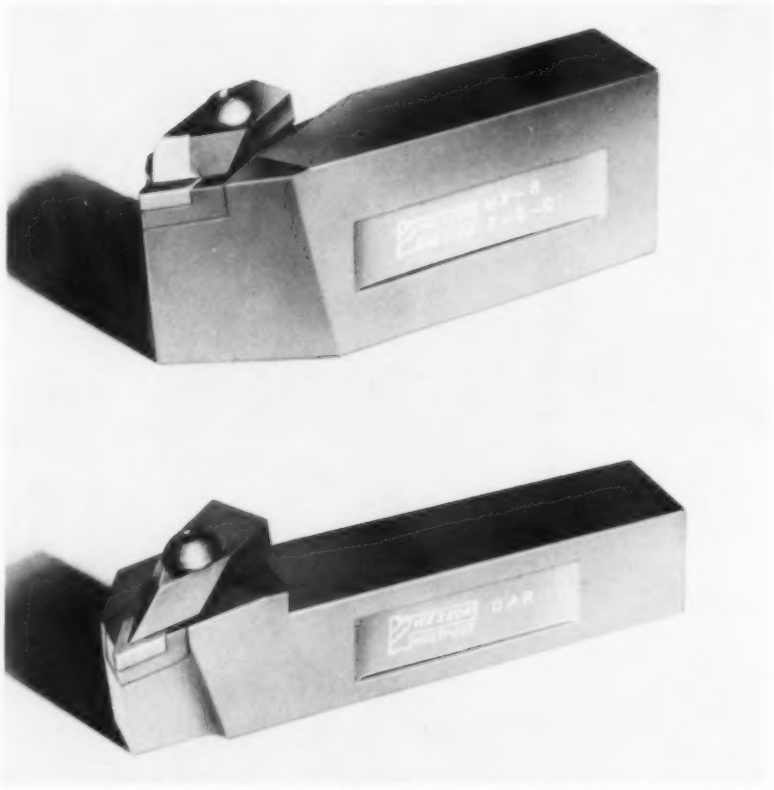
Oscillating Tool Grinder Described in Bulletin

New "Poweramic" oscillating tool grinder is described in a 6-page, 3-color bulletin just released by Wesson. Designed for offhand grinding of standard and special single point carbide tools, the grinder takes the skill and effort out of grinding carbides, boosts output and gives finer finishes.

The oscillating wheel moves through a true arc at 150 strokes per minute, tool being held in a fixed position. Faster metal removal, hone-like (double cross-hatch) finishes and elimination of manual lateral tool movement are among features illustrated and described.

For full details on the Poweramic grinder write Wesson for Bulletin 56-A.

New Holders Use Diamond Shaped Throw-Away Inserts



Above is the MX-8-T5C holder specially designed for production copy turning lathes. Below is the right hand (DAR) model for plunge turning and facing.

Three new holders for throw-away inserts have been added to the Wesson Multicut line. All three tools use Wesson standard diamond shaped D-55 throw-away inserts. The holders, designated as semi-standard, mount the insert right hand (DAR), left hand (DAL) and centrally (MX-8-T5C).

All features, including method of locking and clamping, use of adjustable chip breaker clamp, anvil relieved for built-up edge, etc. are similar to those in the standard line of Multicut holders.

DAR and DAL holders are particularly suitable for plunge turning and facing operations. The MX-8 type is designed for use on various production copy lathes and, on machines of this type, frequently eliminates subsequent finish turning or grinding operations.

Each insert used in any of the three holders in this series has four cutting edges. It is indexed progressively and discarded after all edges are used up.

For additional details on these holders ask for Bulletins DAR-DAL and MX-8.

tools Wesson carbide Wessonmetal
WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 LEICESTER AVE., TORONTO 18, ONTARIO

maker, but if it is to be a tough grind it should be so as a result of realistic reasons. It should be tough as a result of economic and competitive reasons and not as a consequence of any artificial barriers. As a result of it being made tough, many trainees will be forced out; perhaps some of them would have made good toolmakers. There are many young fellows who have lots of ability but cannot even consider an apprenticeship because of economic reasons. This is not an unusual situation; it is true all through life. We must be realistic and face the facts.

The best conditions result when the natural laws of economics are allowed to control. The amount of money that the company pays the apprentices should not be artificially set. It must be high enough to attract a sufficient number of candidates, and it should be increased as the students progress to insure having enough of them finish the course to provide the company with the toolmakers it needs. In short, it should be adjusted to the amount that will produce the desired result.

William Martin
Brooklyn, NY

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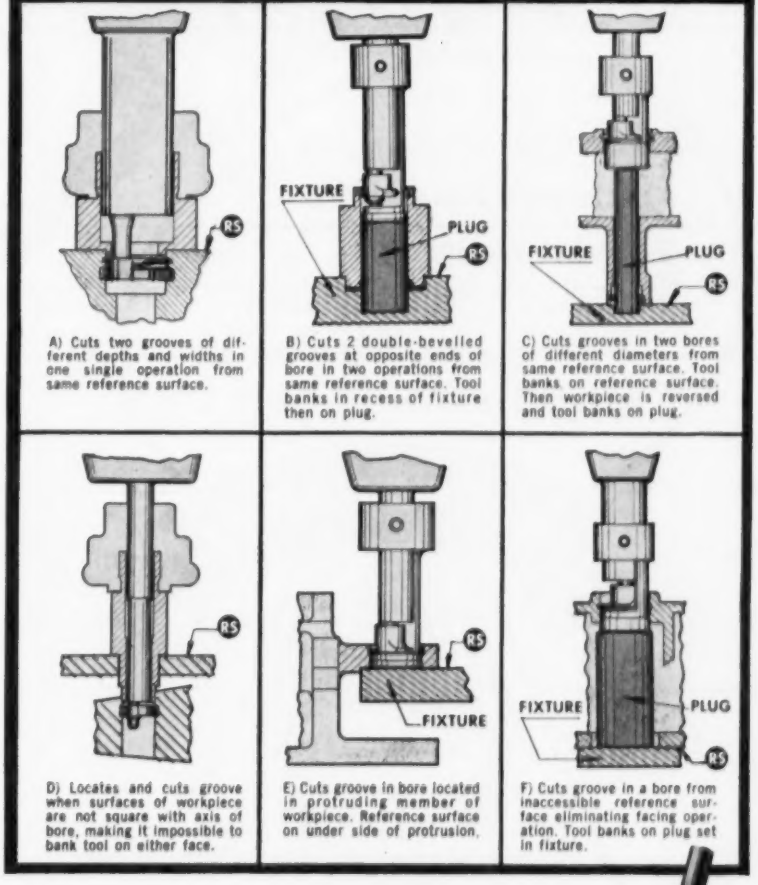
Can rumors be dispelled by an official company explanation posted on something similar to a bulletin board? Will employees accept such an explanation, or view it with a jaundiced eye as just some more management propaganda?

IN MANY SHOPS they have the rumormonger. We also have the buck-passer and the politician.

The rumor-monger knows everything about everybody. You will often hear him say, "Here's the dirt;

"Boss said he didn't mind if I sawed fireplace wood with the rear end as long as I keep the front end cutting chips."

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool

WALDES
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GROOVING TOOL

Made by the Manufacturers of Waldes Truarc Retaining Rings
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.
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here's what they are going to do." He is the gossip-hound who knows more about the shop than any one else. He is only interested in the politics of the organization. We often find the political type along with the buck-passer in a supervisory position, or a so-called key man. They go to the various offices to find out what they can so they can tell the boys. They are the middle-of-the-road boys. They love everybody. When there is a question to be answered, or any responsibility to be taken, they do not take it. They shove it off to the big boss.

Every effort should be taken to root out the rumor-peddler. They do a great deal of harm.

When possible, deal with these boys straight from the shoulder. If they have good qualities, let them know about them. Then let them know in no uncertain terms you will not stand for rumor-peddling.

A E Salmons
Norristown, Penna

•

Will eliminating the time-clock method of recording hours worked tend to raise morale? Will the men —on their honor—remain punctual, or will they abuse the privilege?

I am wondering if I may be in order to hark back to this vitally important subject, just because of its importance to all who handle and direct industry. It would be most helpful and much appreciated if contributors who favor dispensing with time clocks would be a little more expansive in justification of their contentions.

In your Chicago Show issue of past August one contributor writes "I am in favor of the type of enlightened thinking which is now prevalent in *some* companies and is evidenced by taking their men off the clock and letting them fill out their own time cards each week," and, "Recently I read about *one* company up New England way who took their employees off the clock;" again, "In *one* company I read about, after one year of no clock-punching, the records showed tardiness down 47 per cent and only one person who tried to beat the new system."

Phrases such as "prevalent in *some companies*," "*one company* up New England way," "in *one company* I read about," (the italics are mine) don't tell interested executives very much and don't seem to carry a

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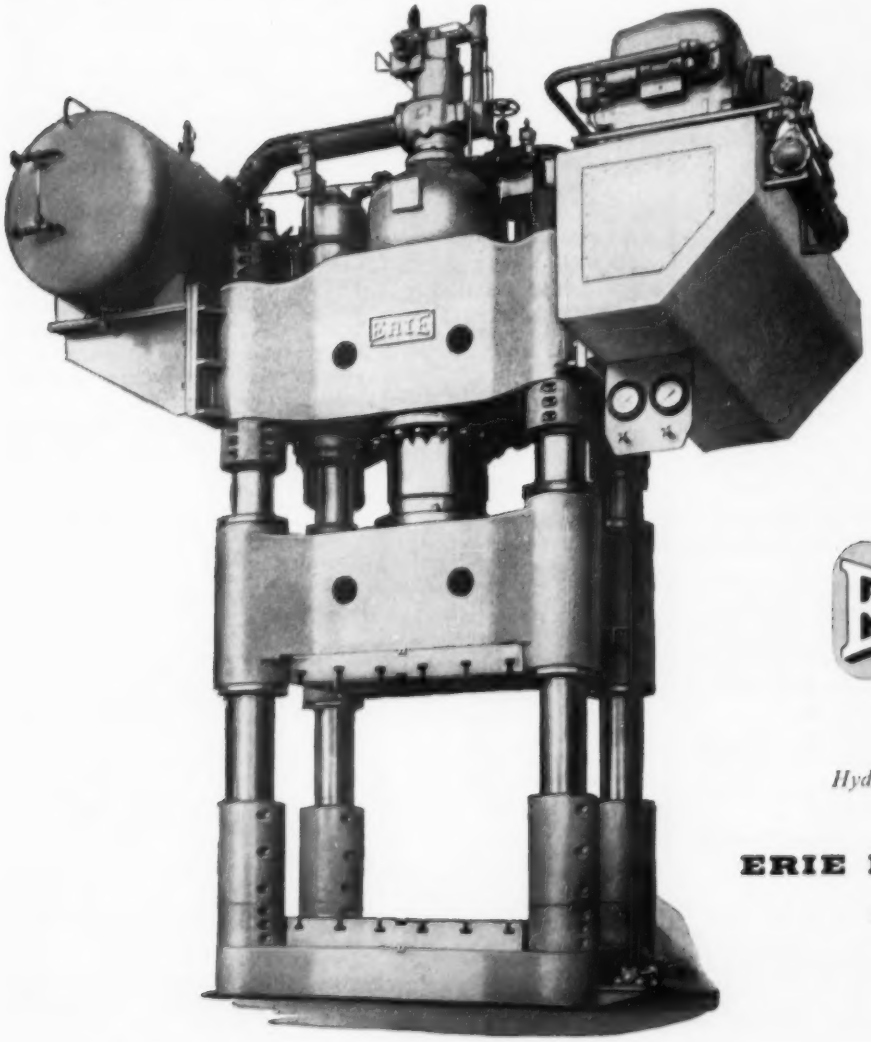

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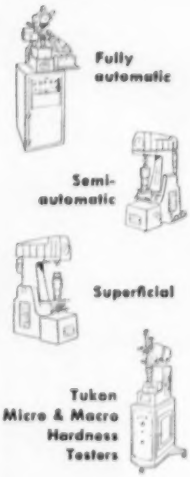

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great measure of conviction. For example, it would be interesting to know approximately how many employees were affected in each of the three companies concerned and, if possible, who the companies are.

The names of the pioneer companies will probably not be a top secret, since such bold adventuring will presumably have attracted much attention in American industrial circles. If contributors have knowledge of companies embarked on such a revolutionary administrative change, many over here in Britain would, I feel sure, be glad to know more about them and might hope to get some useful information from them on the subject.

With the America-Britain industrial Entente Cordiale operating expensively, American concerns dispensing with time clocks and permitting employees to fill in their own time sheets, would doubtless be willing to share their experiences with interested executives on this side of the pond. Personally, I am frankly skeptical but open to conviction. I know that Round Table contributions are merely expressions of the opinions of the contributors but when confident claims are made in connection with important administrative experiments something concrete in support would be very helpful.

The foregoing is not offered by way of criticism but is the expression of a desire to keep in touch with present American practice, and is prompted by the editorial suggestion that contributors' opinions may help guide others.

C Donald Mackinnon
Glasgow, Scotland

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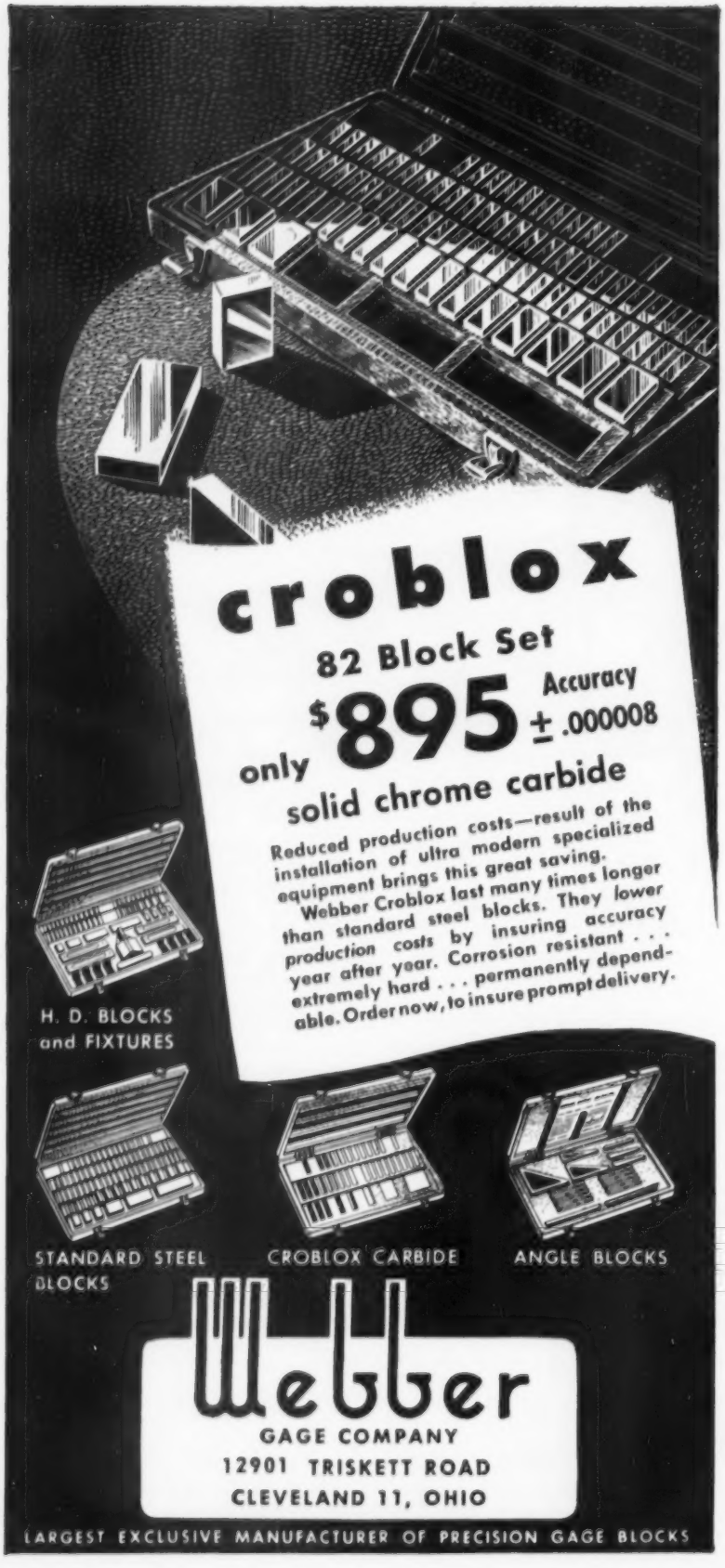
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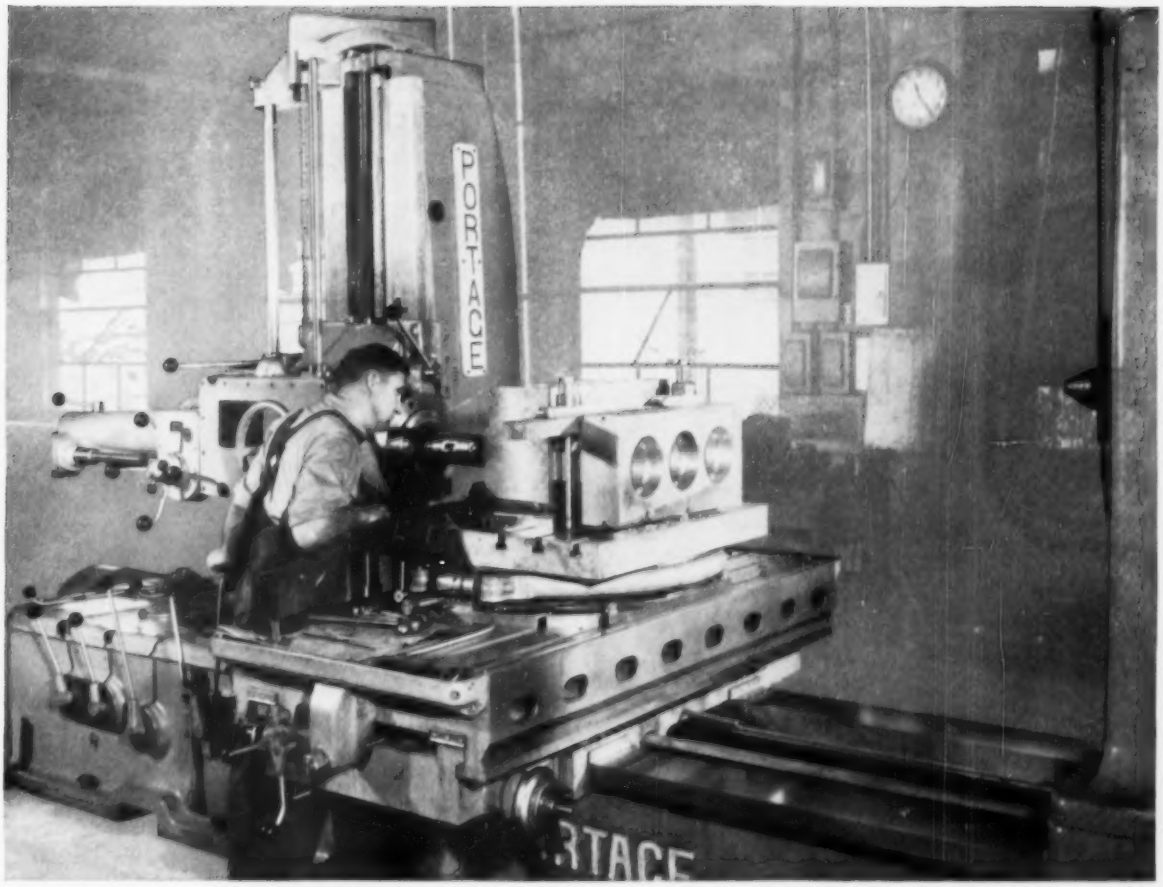
TIME-AND-A-HALF VACATION

If a man has missed a day's work because of illness, is it fair to expect him to work on Saturday for straight-time pay? Or should he be given regular time-and-a-half, despite his sick-day off?

Occasionally one will find a firm whose attitude of fairness is questionable, but on the whole, from my observations, they are more than willing to go the extra mile to see that their employees get what is coming to them. I cannot say as much for some of my friends who are out to get all they can from the firm they know is liberal in its treatment of its employees. Particularly have I detected an effort on their part to ride the forty-hour week to the limit. The expression "give and take" isn't in their vocabulary.

It's all very well to get what is coming to one but this can be done in all fairness. When we have a law that says that all hours over forty a week must be paid on a basis of time-and-a-half I cannot see why workers cannot accept it at its face value and be cooperative in its fulfillment. On the other hand one cannot blame a firm for taking advantage of every situation it can whereby it doesn't have to pay out the extra money. To maintain a business with profit these days requires keen management, always on the lookout for possibilities of making money as well as the saving of it. The same with the worker: he's in business for himself and is constantly on the lookout to see that he has all that is coming to him. Once give him a taste of time-and-a-half and it's pretty hard to get him to think in terms of straight time on a Saturday even though he hasn't put in the forty hours for the week.

In the old days of sixteen-cent steak and five cent beer with a free lunch thrown in for an appetizer, we looked forward to the chance of putting in overtime which a certain large corporation paid for at the rate of time-and-a-quarter. If my memory serves me right we put in ten hours a day for six days a week. We had no national stipulation of a certain number of hours to be worked before the overtime rate would go into effect. After we had worked the ten hours for a day we were so pooped that it was felt by the holder of the bacon that we were deserving of a little gravy on our potatoes. Boy, didn't we keep a little black book up to date to make certain that we got all that was coming to us! Our



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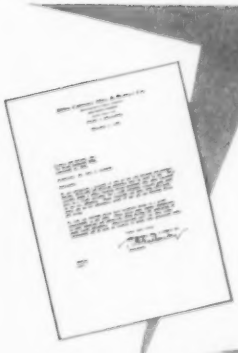

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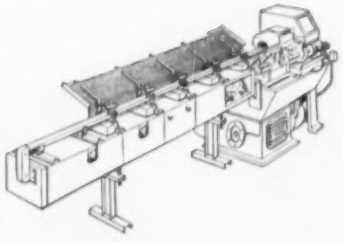

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consciences wouldn't let us make any deductions for crawling up into the stock room above the shop where we would knock off a couple of hours of sound sleep on a spread of clean, colored waste. These blessed periods took place of course when we were on an all-night emergency. Those were the good old days!

Since coming of age—the age of retirement wherein sounder judgment prevails over rash decisions—my heart goes out to the honest employer with the hope that he will receive the all-out support of the worker, that the worker will do his utmost to cooperate in seeing that the forty-hour law is upheld. I maintain that it is up to the worker to get all that is coming to him for the work he does, but for a man to deliberately refuse to put in a day, which happens to fall in a holiday week or after having lost a day on account of sickness, because he isn't going to be paid time-and-a-half isn't cricket. It isn't shooting square with the employer or the law put into effect for his own interest.

Wally Hunter
Ambridge, Penna

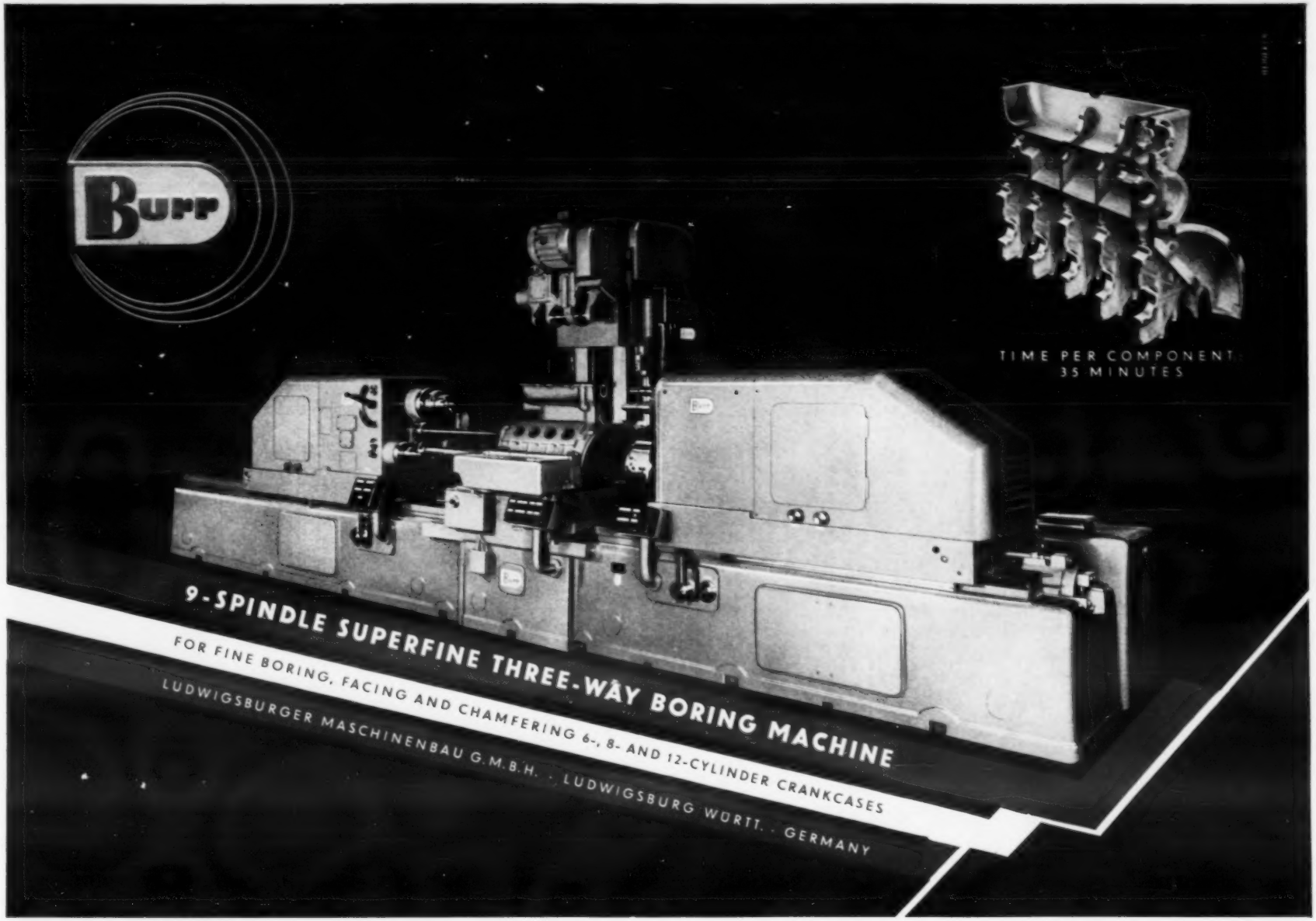
•

What is the best way to handle the problem of taking on a man in the shop on the supervisor's recommendation that he is a friend of his? Should a foreman refuse if he is dissatisfied with the man's ability?

THE NEW EMPLOYEE who is a friend of the superintendent does not come up to expectations of the foreman. The foreman expects too much from an employee because he is a friend of Harrison's.

There are other things to be con-

"I must say you're catching on fast, Gregson . . . caught your pants leg in a machine yesterday, and a finger today."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sidered in this problem. How much does the new worker get paid? Is he familiar with the type of work? There are times when these new employees fool you. Some men only need to become familiar with new shop and surroundings to get back in stride.

It seems to me that the foreman should go along with the new machinist and give him a fair trial. This should not present too much of a problem as the man involved is admittedly a passable machinist. I can remember during the war when we had to make machinists out of butchers, bakers, barbers and most all other trades and professions. What a job that was! The surprising part was that many of these men made good and stayed in the shop.

I think the important thing to consider is the new worker's attitude, along with general ability and skill. A man's mental attitude toward the job and the company should be good. If it is not I would advise dismissal as soon as possible.

A E Salmons
Norristown, Pa

•

Should a fixed minimum on education for shop men be set? Is it practical to demand a high-school diploma from a worker if the foreman is convinced of his potentialities, even though the man has not completed such a course?

PERSONNEL or the management group that sets up a rigid educational requirement is not performing its function but is circumventing it. It is their responsibility to individually determine whether or not an applicant has sufficient intelligence and ability to perform the job he is being considered for. Setting up a fixed educational requirement is just an easy way of eliminating a part of their work. While this results in a saving of time and effort on their part the net result is a loss to the company because it automatically eliminates a lot of men who would be valuable. When an applicant is applying for his or her first job it is all right to attach prime importance to their educational background, for that is the only basis available. However as time goes by and a man goes from job to job his school education recedes into the background and becomes less and less significant. Why should an applicant be judged on the basis of grades he received at school, perhaps 20 years ago?

The industrial organization which sets up strict educational requirements for its employees is making a serious mistake. A diploma, high school or otherwise, is not a measure of ability. It means that the person was exposed to courses of instruction, but it does not say whether or not the courses took. There are many people with a high degree of intelligence and natural ability who never had the opportunity to complete their formal schooling. These people can be assets to an organization. There are also many foreign-born mechanics who have had little if any schooling, but they are good workers just the same. Foreign-born applicants find it difficult to obtain and present proof of their education. This problem is further complicated by variations in the type of instruction and the different levels at which

I WAS TRYING TO LINE UP THE CROSS HOLES BY "FEEL"— THEY HIT IT TOO HARD— MY FINGER IS CAUGHT— DO SOMETHING! QUICK!!
WE COULD CUT THE FINGER OFF—WOULD BE BETTER THAN SPOILING A GOOD CASTING—MAYBE IF WE HEATED THE CASTING THE SHAFT WOULD LOOSEN UP.
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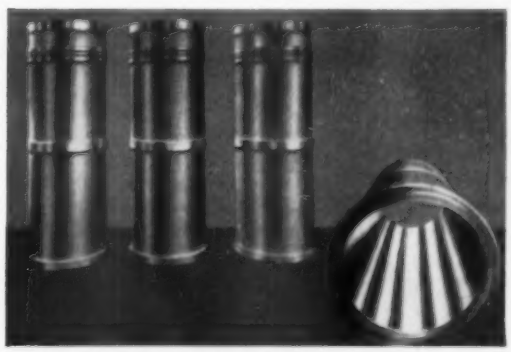

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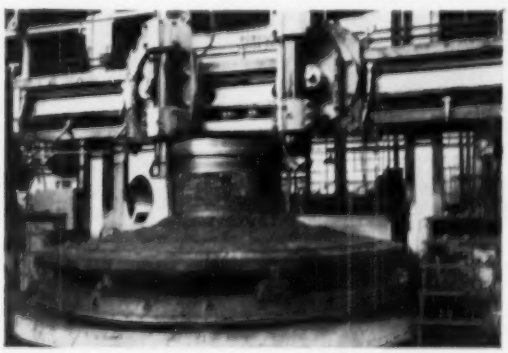

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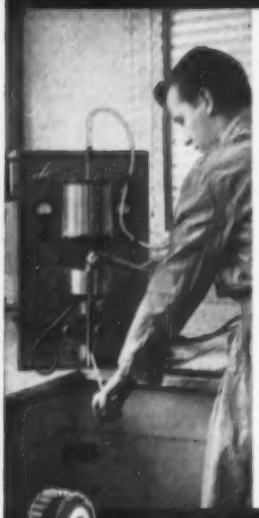

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students are graduated in different countries.

The best procedure is to set up flexible requirements for each job to serve as a guide for hiring. Some organizations give the applicants one or more tests before the personal interview. The results of these tests constitute a valuable record for future reference. They can be used when employees are being scanned to find a man for promotion. For example, a toolmaker may be under consideration for advancement to foreman. The foreman's job has additional requirements beyond those of the toolmaker, as writing accident reports or schedules. Reference to these tests will give an indication of the amount of ability the man has.

The differences which exist between people preclude the possibility of using rigid job requirements. The best system is a flexible one which can bend to meet each situation.

Clifford Molloy
Bronx, N Y

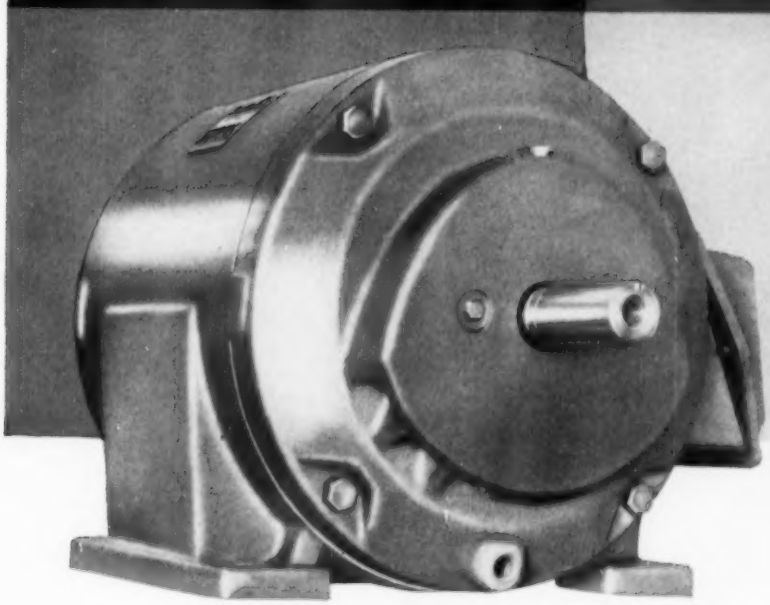
A GOOD EDUCATION is a most valuable asset, but to condemn a man simply because he did not finish school without finding out the reason why, is downright stupid. A Personnel Department that operates on the theory of "No Diploma, No Job," is very liable to miss potentially valuable men. Such a department, for example, would have turned Thomas A Edison down almost before he got in the room, since he had only three months at a public school. The same department would not have given a second thought to hiring Henry Ford the moment they learned that he left school when he was about fifteen.

Someone should tell that Personnel Department the story of the mountaineer who was drafted and when examined said he thought he was at his best when using a rifle. The young doctor gave him an eye test and he failed in everything; could not even spot letters at twenty feet. Was rated zero and sent back. Through some misunderstanding he got mixed in with the fellows who had passed and landed on the range. A few hours later the young doctor happened to be passing and nearly had heart failure when he saw the mountaineer swinging a rifle about. "Take that rifle away from him before he kills someone," he said. "I doubt if that man could see a cow at thirty paces."

"You're crazy," snapped in the instructor, "that guy is the finest and fastest shot I've ever met. It's amazing what he can do with just standard rifle equipment."

The doctor was bewildered. "Why,

Totally Protected



FROM CORE TO COVER

RELIANCE *Totally Protected* MOTORS

The total protection concept of design and construction armors Reliance A-c. Motors against everyday hazards, with little or no maintenance. Total protection is made up of extra features like:

Slot cell insulation of Double Backed Mylar

Dynamically balanced rotor for vibrationless operation

Entire insulation system impervious to acids, moisture and oils

Metering plate regulates grease flow to bearing

Ventilation louvres positioned high and dry in end brackets

There are 100 of these extra core to cover protection features in Reliance Motors. Each point is covered in our bulletin, "Check the Facts". Why don't you write for one and get all the details?

B-1810

RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 18A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO

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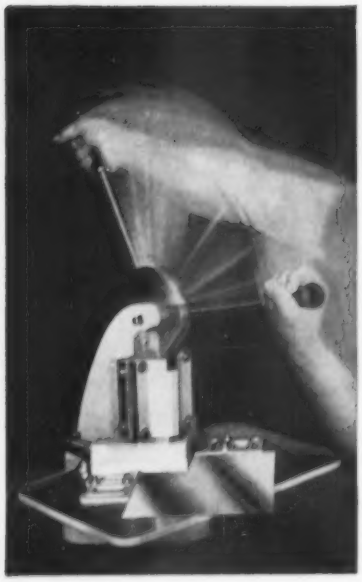
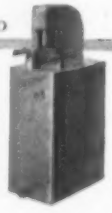


Notching Sheet Materials?

Do It Quickly, Easily with a DI-ACRO* NOTCHER

Speed up notching operations, eliminate the need for heavy presses and dies with a Di-Acro Notcher. A 6"x6" notch can be made in 16 gauge material in one operation. Many straight shearing jobs also performed.

*pronounced DIE-ACK-RO



BOTH HAND AND POWER OPERATED MODELS AVAILABLE

Di-Acro Power Notcher is especially designed for operations where high rate of production must be maintained. Motor driven flywheel and all moving parts housed in welded, steel cabinet.

Hand operated Di-Acro Notcher is ideal for short run production or experimental use.

WANT MORE INFORMATION?

New Punch and Notcher book is yours for the asking. Consult the yellow pages of your phone book for the name of your nearest Di-Acro distributor or write us.

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311 8th Ave.
Lake City, Minn.

di-acro PRECISION METALWORKING MACHINES

on the chart test at twenty feet he still said he couldn't understand the letters."

"Did you ask him first if he knew the alphabet?"

"No."

"Well he doesn't know A from Z; he's never been to school, but boy, can that guy shoot. I'll take all you can find like him an' then lick any army on earth."

Diplomas are valuable. They are certificates of knowledge and help a competent man to start at a higher level and better pay, but the man who does not have one should not be arbitrarily eliminated. A thorough check should be made as to the reason why he does not possess one, for if he never had an opportunity to try for one he should be helped and tested, but if he has had the opportunity and has failed then he can be politely put through the door which has the single word EXIT on it.

George P Pearce
Albuquerque, N M

•

Are compulsory physical examinations an invasion of privacy? Does a company have the right to check up on its workers as it does on its machines to assure full production?

No MAN can live entirely unto himself. Everything we do or neglect to do directly or indirectly affects others. That is as true of our industrial contacts as of our social or domestic interests. A man's health is, of course, peculiarly his chief concern but, if he is married, his wife and family have a vested interest in the state of it, so actually his health is not his own affair.

Many good reasons could be advanced in favor of compulsory medical examination. One is that it is something for nothing, and is therefore somewhat unique in these times. Besides being a safeguard for the individual, it is an insurance to others among whom the individual may work. Some infectious diseases can be innocently carried around for a long time before the victim has to lie up, or is even definitely aware of infection.

Much TB has been spread around in the past by some who have suspected the infection, but who have been unwilling or afraid to consult a doctor. In a less creditable connection, men, who by their own folly have contracted infectious disease, have persisted in remaining at work when no man should have been asked to use tools which those degenerates had handled. Compulsory medical examination would protect others in such deplorable circumstances.

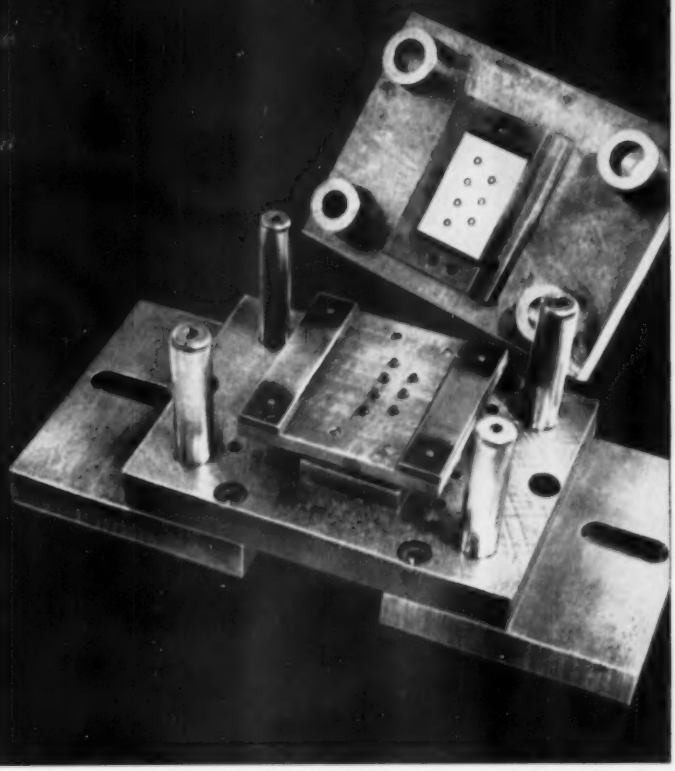
Is it up to the employer to safeguard the men's health? Without doubt, the state of his employees' health, on purely materialistic grounds, is of greater importance to the employer than the state of the plant, in some respects. A machine may be long past its best, yet capable of producing acceptable work if operated by a healthy, alert operator who knows his job, is full of beans, and interested in his work. No sick man could scale those heights. Furthermore, no machine of uncertain age and poor condition can affect any other machine as a sick man can cause the unhelpful impact of his poor physical or mental state to adversely affect those who work around or with him.

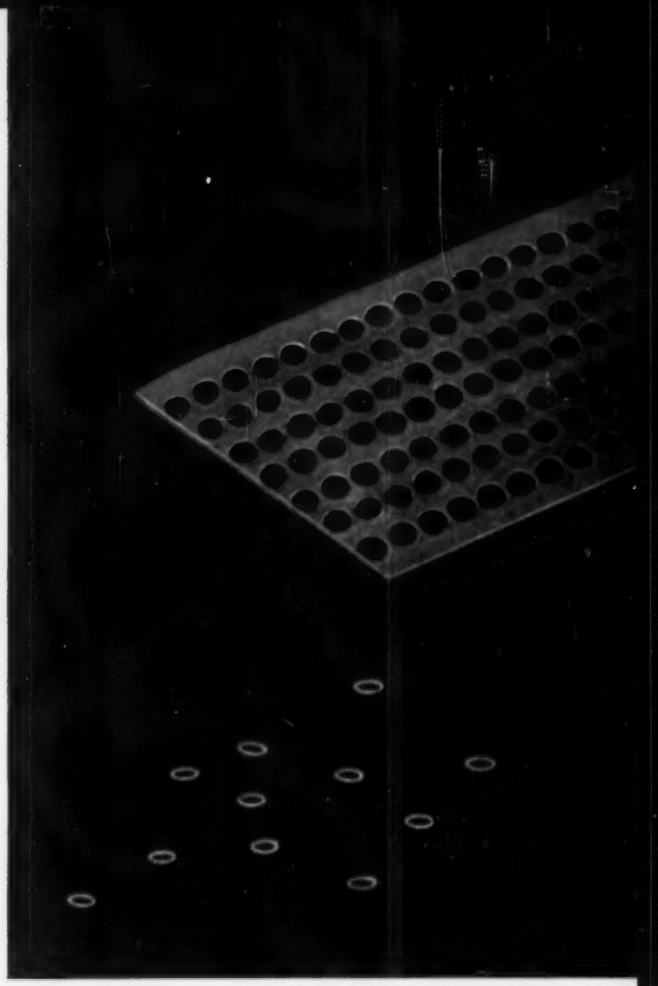
Mobility, cheerfulness, and helpfulness in the individual are the components of good teamwork and successful endeavor. Those characteristics are not to be found in the subnormal employee. To my mind, the most important single factor in a production sense is the state of health of all employees from the top down. It is of paramount importance to all employers that the health of the employees be safeguarded at all costs and the highest medical skill obtainable should be harnessed to the cause. If it is objected that employers cannot afford to foot the bill, the fact is they cannot afford not to.

I cannot understand Ed's reluctance over compulsory medical examination. He surely does not believe that freedom consists of doing only those things one likes and wants to do, irrespective of the effect on others. That would be the very negation of freedom, and an insufferable intolerance. There are so many things we are compelled to do, without being robbed of our essential freedoms I fail to see the difference between a medical examination prior to engagement and a routine check-up during service. If Ed accepts the one and rejects the other he is being the reverse of logical.

If a routine check revealed that a foreman had a chronic disease, that would be very unpleasant news for the unfortunate foreman. We can all appreciate any man's anxiety concerning such a contingency, but continued ignorance of his plight would not help in any way, whereas recognition of it, and prompt medical action might. The fact that a disease is chronic is no guarantee

FIELD REPORT: NO. 87





WHICH DIE STEEL WOULD YOU USE HERE to boost production per grind 500%?

These tools blank out dead soft brass washers, .170" O.D. x .100" I.D., .009" thick, on a punch press at 186 strokes per minute. It is an exacting job for a couple of reasons. First, it involves a government contract and strict delivery schedules have to be maintained. Then too, the punch and die are set up to blank seven washers per stroke and have to do this for many millions of pieces . . . and still remain within burr limitations set up by the government. Performance from the steel used in the past was far from satisfactory . . . to maintain schedules, production had to be substantially increased.

Suppose the decision were up to you. Which die steel would you be willing to recommend for steady, trouble-free production?

In this Field Report from customer files, here's what happened: The Carpenter Matched Set Diagram was consulted and Carpenter No. 610 (Air-Wear) was selected. Since then No. 610 has enabled the Company to hold delivery schedules comfortably . . . racking up increases in production per grind as high as 500%. And this is especially significant when you realize that five hours' downtime is involved each time the tools have to be reground. Total parts to date: 5,500,000 . . . and the tool is still good for about 15 regrinds of .003" each.

Why make the tough decisions alone, when Carpenter's service organization is sincerely interested and equipped to work with you? A move in the right direction would be to call your nearest Carpenter Mill-Branch Warehouse, Office, or Distributor, now.

Your toolroom can use Carpenter Matched Tool and Die Steels to:

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- Minimize machine downtime
- Boost output per grind
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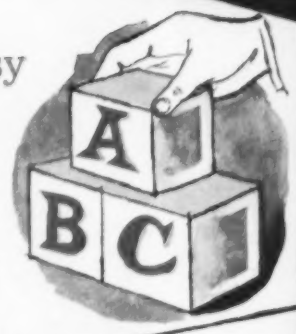

any number
of basic units
can be
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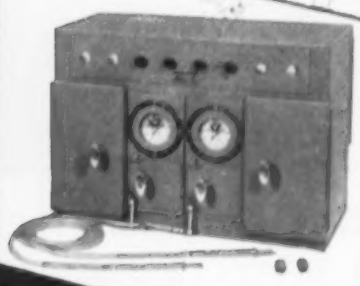
as required



* **Automation Gaging . . .** uses a "feed-back" control system to re-set the machine as required to maintain work tolerances AUTOMATICALLY at all times. The results are: increased production, greater accuracy, fewer rejects . . . and greater profits!

AND NOW . . . an Automation Gaging installation . . . custom tailored to your exact needs . . . can be assembled quickly and easily from standard, in-stock Pratt & Whitney Package Units. The big expense and long delays of specially constructed control equipment are eliminated.

LEARN HOW practical the advantages of Automation Gaging can be applied to your production lines. Phone the nearby P&W Branch Office and ask a Pratt & Whitney Gage Specialist to call at your plant . . . or write direct to West Hartford outlining your requirements.

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MACHINE TOOLS • GAGES • CUTTING TOOLS

or proof that the medicine man cannot alleviate the condition and make the discharge of foremanship responsibility less arduous than if the matter was allowed to drift and take its course.

We mostly all dread going to consult a doctor if we suspect a major derangement, but putting off and continuing to suspect may make us less fit for our work than would the medically controlled onset of the actual disease.

The important point to observe is that a check-up causes no harm and may be the means of halting the spread of disease in an affected organ. Check-up or no check-up, no foreman can hope to effectively hold down his job if he is afflicted with a chronic disease. It will soon become apparent if his grip on the job begins to falter. If at the time of the check-up the foreman's health had deteriorated to the extent of preventing him from effectively holding down his job, that fact should have been noted by his chief earlier.

Because of two similar cases with which I am presently in touch, I am interested in Ed's concern about a check-up on him, perhaps disclosing a heart condition, and the fact that he is nearing retirement age. Two of my colleagues are nearing retirement, one with hitherto unsuspected TB, the other threatened with blindness. The method of dealing with these cases may be of interest. In spite of putting up a good fight, it is now clear that neither can hope to effectively hold the job down any longer.

To ease their burden, and to continue to enjoy the benefit of their wide experience, the company has promoted two promising juniors and retained the two afflicted chiefs in a consultative capacity, with no al-

"Look J. B. Just because your ulcers are acting up is no reason to start stirring up mine!"

- **At last...*low cost* coolant clarification that provides...**
- **Longer coolant life.**
- **Eliminates costly filter replacements.**
- **Insures fewer grinding wheel dressings... less down time for tool replacement.**
- **And takes out *every* type of contaminant!**

NEW DE LAVAL TURBO-COOLANT CLARIFIER

The new De Laval Model 115 Coolant Clarifier is designed for *individual use* on grinding, honing or turning units... takes up minimum floor space (2 feet diameter by less than 2 feet height)... gives you complete efficiency with amazing low cost!

This new De Laval Coolant Clarifier handles all types of coolants—both oil and aqueous... can be supplied with a skimming device for handling volatile liquids.

Get all the details on De Laval's *new* Turbo-Coolant clarifier... that offers great new advantages at unmatched low cost!... *today.*

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last longer...

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wear reduced as much as 80% with easy-to-move

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MANY COMPACT MODELS . . . all self-contained. Unitized for custom installation. More economical, usually more efficient than central (built-into-the-building) systems. For more information, write today to . . .

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311 Walnut Street,
St. Paul 2, Minn.

teration in salary, in the hope that they may thus be able to carry on till retiring at 65 on full pension. If that hope is not realized, they go on a breakdown-pension till they reach 65, when they fully qualify.

C Donald
Lanarkshire, Scotland

There was a time when the foreman or straw boss just gave a man a quick visual inspection before hiring him. The principle was that they were providing him with work and it was exclusively the employee's responsibility to decide if he could perform the work without suffering physical injury. At the present time all but some of the very small companies require the applicant to submit to a complete physical examination as a prerequisite to employment. Many organizations who do not have a staff physician send the applicants to a local doctor for this.

The company has every right to require the prospective employees to take such an examination and to come up to their minimum requirements. A purchaser is regarded as foolish if he does not check the quantity and quality of the articles he purchases. The company pays for all the goods that they receive and it is only common sense that they should inspect every item. In like manner they are paying their employees to perform a service, and they have every right to check the employee to see that he is capable of performing this service.

These examinations are of great benefit, even if the person is rejected. There are many people who never think to visit their doctor for an examination or check up. Many people take better care of their car or watch than they do of themselves. They have them cleaned and checked regularly to prevent any faults from developing. Yet when it comes to a question of their own health they procrastinate and keep putting off any sort of check-up.

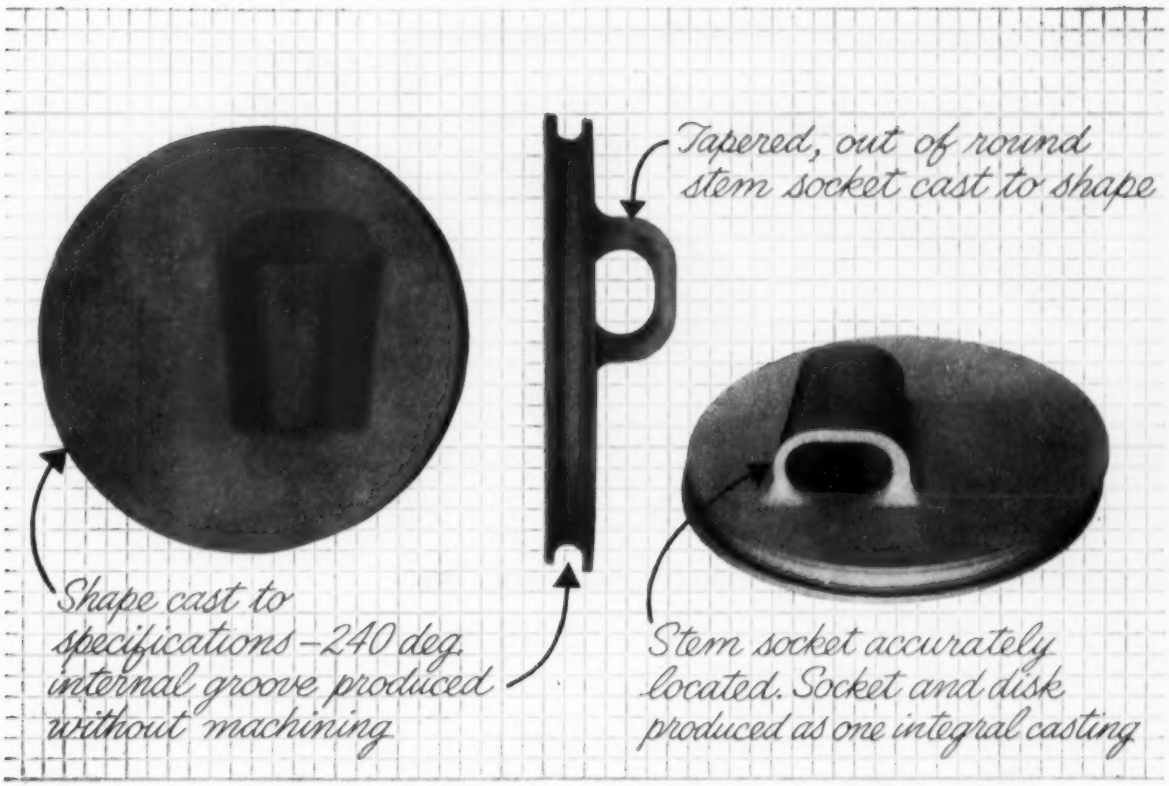
There are plenty of diemakers and machine operators whose work is falling off because of their failure to have their vision checked. There are many activities in the plant where lives depend upon the alertness of a particular worker. Periodic examination of these people is warranted in order to protect the other employees. Elevators, cranes, trucks, and machines are all checked at regular intervals to see that they are in safe operating condition. Why overlook the human factor? It is one of the common causes of accidents. It is unfair to jeopardize the lives of men by permitting unsafe equipment to be used. It is equally wrong to allow men to go on working year after year without checking on their health to see that they are capable of performing their work safely.

It is very possible for a man to be unaware of his shortcomings. It is also quite possible that a man is performing work which is too strenuous or difficult for him without his being aware of it. A physical examination will uncover this condition and prevent permanent impairment of his health or premature death.

Every organization which can manage to do so should initiate a program of regular, periodic physical examinations.

Ernest Jones
Bronx, NY

LOOK FOR YOURSELF - YOU DIDN'T LOOSE YOUR HANDS - I TOLD YOU NOT TO HOLD ANYTHING WHILE SOME CLOWN SMACKS IT! YOU HAVE JUST EXPERIENCED ONE FORM OF VIBRATION.
HE'S GONNA BE AN A"1 ENGINEER-COLLEGE AN' FOUR YEARS IN TH' SHOP.
YEP! THEN WINDS UP IN SALES OR EDITOR OF A TOP MAGAZINE.


Tapered, out of round stem socket cast to shape
Shape cast to specifications – 240 deg. internal groove produced without machining
Stem socket accurately located. Socket and disk produced as one integral casting

Investment-Cast in One Piece . . . 5 Secondary Operations Avoided

This intricate valve disk and stem socket were investment cast at a considerable saving in machining, assembling, and joining costs. The disk is produced in an odd shape and has a concave rim with a 240-degree groove. There is a tapered, out-of-round recess in the stem socket. The disk and socket were designed and produced as one integral casting.

The shape of the disk, vital to the proper functioning of the part, was cast to size. A contour machining operation would have been required to produce this shape by other methods. The groove in the rim of the disk, and the stem socket, were also cast to size . . . thus eliminating two more difficult machining operations.

An assembly operation, which would have required precision locating devices, was also avoided. The stem socket had to be accurately located . . . 0.225 in. from the centerline of the disk. This location was held to within plus or minus 0.005 in. on the finished part by the investment-casting method.

Reducing production costs by eliminating secondary operations is only one of the many advantages of HAYNES' precision-investment-casting process. For the full story call or write to any of the District Sales Offices listed below:

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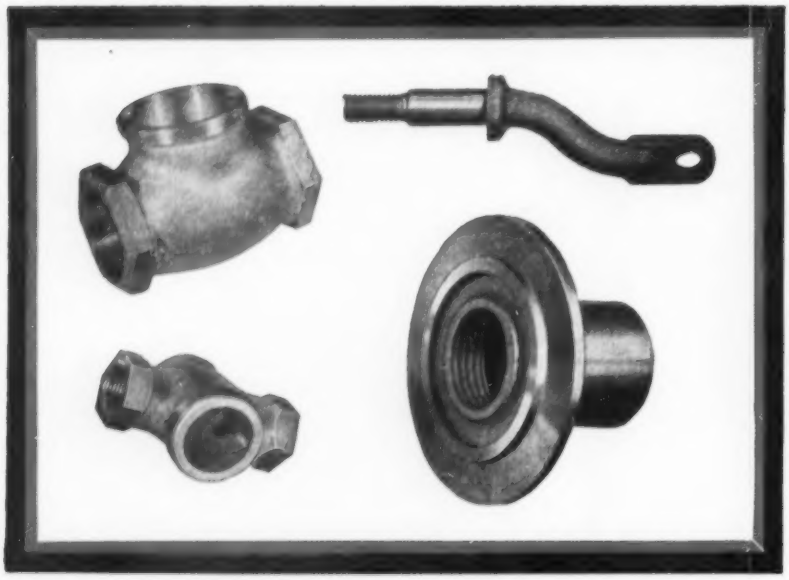
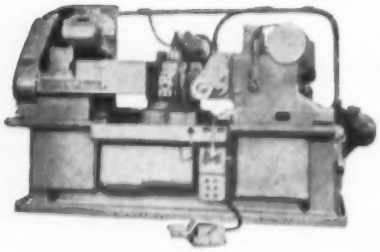


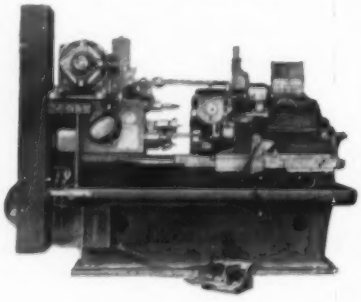
PARTS LIKE THESE and MANY OTHERS ARE BEING PRODUCED

with speed, convenience and economy . . .

on **GOSS & DeLEEUW AUTOMATIC CHUCKERS**



THE "ONE-TWO-THREE" 7-SPINDLE TOOL ROTATING CHUCKING MACHINE can complete in one operation as many as three ends of valve bodies, plumbing fittings, etc. eliminating secondary operations.



4-SPINDLE TOOL ROTATING CHUCKING MACHINES, available in three sizes, combine various turning, boring, facing, threading, multiple drilling and tapping operations on a wide range of single-ended part.

Send samples of your work for time estimates. Ask for illustrated literature.

GOSS and DELEEUW
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GOSS & DELEEUW
QUALITY PRODUCT QUALITY

Is a man right in refusing a promotion to a job that has spelled failure to three former holders of it? Or should he take on the job with the determination that he'll beat the jinx?

The man who is next in line for a position which has resulted in failure for any man who attempted the job seems, at a quick glance, to be on the horns of a dilemma. If he refuses the promotion he may be regarded as uncooperative, or someone who is unwilling to assume responsibility. After such action on his part his chances for advancing with that concern would be slim. If he accepts the offer that assures trouble he might automatically bar success by being unable to cope with the situation.

Nevertheless, a closer observation of the picture might reveal that the ill wind does blow some good.

The fact that so many have been unsuccessful in this aspect of the plant operation would warrant closer supervision from the brass. They might ask for a method analysis in order to get to the root of the trouble. If Hadley accepted the promotion he would be in a position to point out that the method he advocates has never been tried. If there were no other solution to the problem, his method would very likely be given a fair trial. If the results of the analysis pointed to another favorable solution, he would still be at an advantage by being on hand when an answer was reached. Someone is bound to improve the situation sooner or later, and Hadley's victory will be that much greater if he succeeds after so many have failed.

In any event, Hadley has nothing

"Funny thing! I turn in early every night,—get a good sleep,—but when I reach the plant, I'm pooped!"

Square D FOR THE MOST COMPLETE line of Oil-Tight

PUSHBUTTONS

Square D pushbuttons, designed to JIC and NMTBA standards, have been proven by severe tests involving millions of operations. They offer still other features... generous wiring space and exclusive "*Slide and Swing*" enclosure covers for easier, faster installations when machine operations are changed.

OIL-TIGHT OPERATORS

Momentary Contact Guarded button in 7 colors.

Mushroom Button 1⅛" or 2¼". Momentary contact. 7 different colors.

Selector Switch 2 or 3 position with 4 different cams.

Coin-operated Selector Switch Available in same selection as standard type.

Key-operated Selector Switch Discourages unauthorized operation.

Selector Pushbutton combines selector switch and pushbutton. 2 or 3 position.

Padlock Attachment Latch type. For momentary contact buttons. Locks "OFF" position.

Padlock Attachment Covertype. Prevents depressing button.

Maintained Contact Attachment Used with 2 operators, 1 contact block.

Selector Switch Lockout Permits switch to be locked in any one of three positions.

Wobble Stick Operator for momentary pushbutton operator. Ideal for emergency stop with pendant station.

Neoprene Cap for momentary contact button. Prevents liquids, dust and grit from working into pushbutton operator.

CONTACT BLOCKS and PILOT LIGHTS

Single Pole N.O. and N.C. Contacts

Duplex N.O. and N. C. Contacts

Tandem Operation. Duplex N.O. and N.C. Contacts with extended stems for combination with another block.

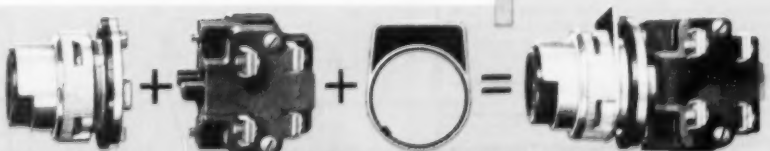
Duplex N.O. and N.C. Contacts with one N.O. circuit closing ahead of the other. Designed for 2-speed or sequence operations.

PILOT LIGHT • Generous illumination and wide-angle visibility. Greatly reduced filament burn-outs. No loosening of lamp under vibration. Six colors—red, amber, green, blue, white, clear.

You'll like the *completeness* of Square D's pushbutton line. Every conceivable combination can be obtained with a minimum stock of packaged units. Enclosures available for 1 to 16 units.

Write for Pushbutton Bulletins which give complete details. Address Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin.

ANY OPERATOR WITH ANY CONTACT BLOCK



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SQUARE D COMPANY

Get smoother, more accurate *holes* with "ground-from-the-solid"

ACE

Drill Length AND *Chucking*

REAMERS

More holes faster . . . and at lower cost! That's what you want from a reamer, and that's what you get from Ace Drill Length and Chucking Reamers! They're made of pre-hardened H.S.S. and produced by the Ace "ground-from-the-solid" process. This gives them their highly polished right-hand spiral flutes . . . plus keener, longer-lasting cutting edges that produce smoother, more accurate holes. They're economical to use, too, particularly the drill length reamers. Because, with flutes nearly twice the length of chucking reamers, they can be re-ground more times for longer useful life. Next time you need reamers, ask your distributor for "ACE". If he doesn't have them, send coupon for complete details.

ACE DRILL CORPORATION
Adrian, Michigan

Gentlemen: Please send me your Catalog No. 52-A containing complete information on ACE "Ground-from-the-Solid" Drills and hardened H.S.S. drill blanks.

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ACE DRILL
ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS

to lose by taking the promotion, and he might be considered lacking in confidence if he refused the offer. He might do well to consider the adage "Nothing ventured, nothing gained."

Catherine McLoughlin
Rockaway Beach, NY

Providing the facts are as stated, Hadley has the right idea. Three foremen in five years should constitute in anyone's book too high a level of expendability, and no one can blame him if he hesitates to become number four on the list.

The fortunate part of the whole thing was that he was in a position to see what happened to the other men he was asked to replace. If he had been hired from outside the organization he would have found out from bitter experience just what the situation was and would have had to conform or find another job. Which isn't too easy, as personnel managers are inclined to take a dim view of the individual who hasn't seemed to fit in in a previous position. The pity of the whole thing is that supervisors of the type Hadley mentions often have to be blasted out of an organization and it sometimes takes years for the top brass to catch up with them.

So, in Hadley's shoes, I feel sure he would be wise to seek new pastures, especially as he feels that by passing up this promotion he won't have a chance should another opening come along. Too often the company "stinker" list is not merely a figment of man's imagination!

The moral of the whole story is simply that a man has to live with himself. If he is content merely to perform the motions of foremanship and do what he is told, knowing that things could be much better, yet smothering his ability for the sake of the weekly paycheck, then nothing can be done for him.

Robert S Alexander
Glastonbury, Conn

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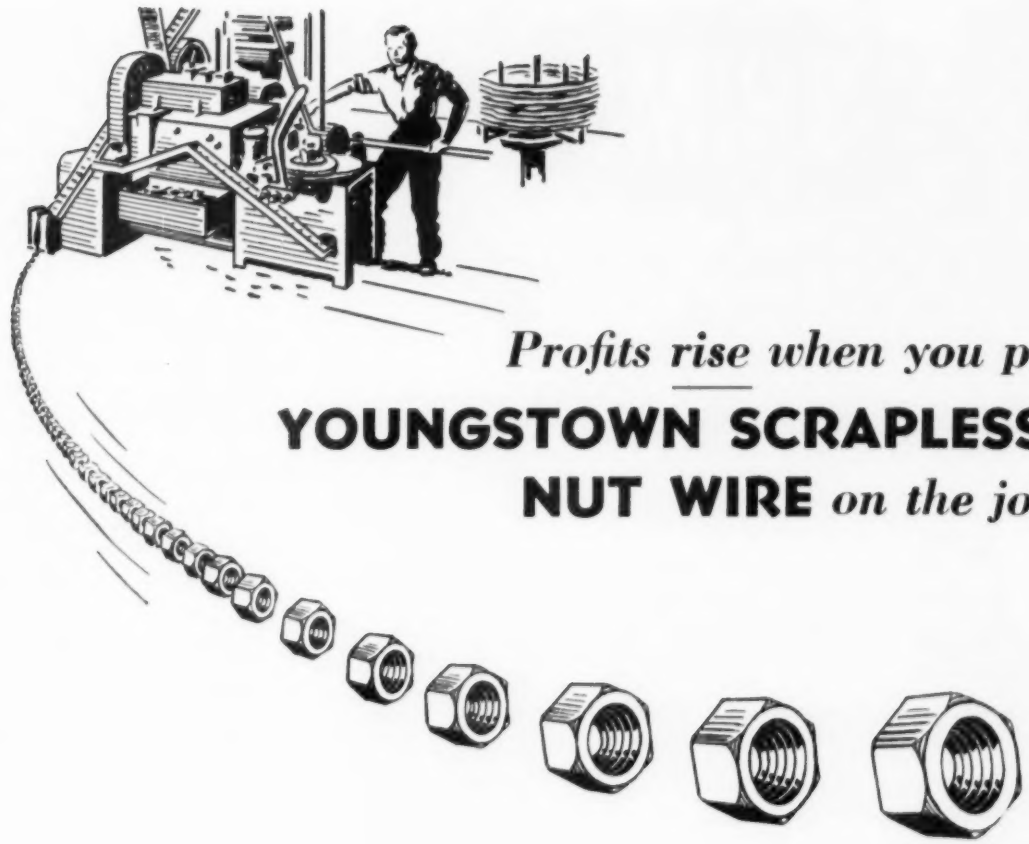

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HADLEY was not smart in turning down the offered promotion to foreman of Dept 72. His abilities, obviously, had been discussed at a manager's meeting and he had been considered the most promising man in the plant for the position; his unexpected turning down of the offer indicated to the company that he had a complete lack of confidence in himself and thus he would promptly be eliminated from future consideration when other opportunities for advancement became available.

His actual private opinion that the foreman of Dept 72 was simply a stepping stone for the supervisor to make a showing may, and probably is, based upon some incorrect, disgruntled cover-up talk made by the prior foreman who was let go. It would be much better for Hadley to find out by personal experience if the charges were correct and, if so, to plan his action to overcome this handicap.

Any firm that permits executives to hire only "yes-men" has obviously passed the top, is on the way down to mediocrity. Therefore, Hadley would not be very smart in staying with such a firm and, furthermore, he could gain nothing and would lose prestige by turning down the promotion to the position of foreman.

Progressive companies do not promote a man into an executive position just because he is a good fellow, or has been with the company for so many years, or is a yes-man, but because his record indicates he possesses executive ability and cannot only delegate work to subordinates who are capable of satisfactorily accomplishing it, but will see to it that the work is done on time. Good, efficient foremen can make the difference between operating at a profit and deteriorating into bankruptcy, and good foremen are hard to find.

George P Pearce
Albuquerque, NM

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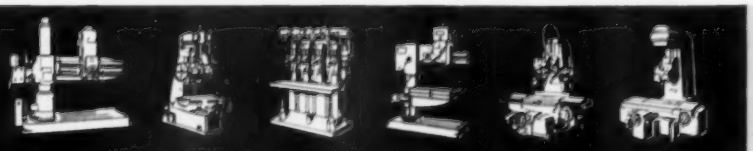

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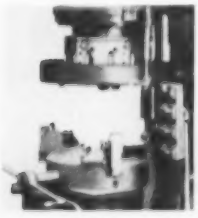

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New Books

TUNGSTEN, THE STORY OF AN INDISPENSABLE METAL — *By Mildred Gwin Andrews. Published by The Tungsten Institute, 1757 K St, NW, Washington 6, DC. 28 pages. Free.*

Essentially a non-technical summary of the history and prospects of tungsten, this small book contains an interesting summary of the growing applications for tungsten and the short history of its strategic importance. Tungsten ores are most plentiful in China, now in Communist hands. Largest source in the Free World today is in South Korea, only a few miles from the 38th parallel.

There is a domestic supply in the U S, however, with mines operating in North Carolina (where the largest single mine is located), California, Nevada, Idaho, Utah, Colorado, Washington, Wyoming, Montana, Arizona, and other Western states.

•

MACHINE TOOL ELECTRICAL STANDARDS (REVISED)—*Published by the National Machine Tool Builders' Association, 2071 East 102nd St, Cleveland 6, Ohio. Thirty-eight 8½ × 11-in. pages. Copies upon request to the Association.*

In their first form, these standards were the work of an Electrical Standards Committee established by the machine-tool industry in 1938. These standards, adoped September 5, 1941, were a composite of many specifications drawn up by machine tool users, machines tool builders and the National Electrical Code authorities.

With further experience, plus suggestions from customers, this manual was revised and re-issued on September 13, 1950, as an Industry Standard. Many of the suggestions in the 1950 and 1954 versions and in the new manual are the result of meetings held with representatives of the mass-production companies represented in the Joint Industry Conference. The JIC also developed its own electrical standards for application to industrial equipment of all kinds used in the continuous or mass-production industries. Essentially, however, they are the same as the Machine Tool Electrical Standards except for 23 additional stipulations, which for convenience are grouped in one of the appendices to the new NMTBA manual.

Providing a much clearer distinc-

tion between practices that are mandatory and those that are simply recommended, the new manual also treats at great length such subjects as motor and circuit protection, control circuits and circuit inclosures, and specifications for conductors. A section devoted to raceways and junction boxes represents considerable new material.

•

HOW TO RUN A SMALL BUSINESS (2ND EDITION)—*By J K Lasser, revised by Sidney Preran. Published by McGraw-Hill Book Company, Inc, 330 W 42nd St, New York 36, NY. 332 pages, 6 x 9 in. Price $4.95*

A working knowledge of financing, taxes, accounting insurance, law, office management, and promotion is essential to successful management of a business today. There are specialists in all these fields, of course, but the small businessman must be familiar enough with these subjects to be sure his interests are being properly handled. If they aren't, his business will fail, as so many do.

This is now a familiar guide on the subject—a practical approach, easy to read and understand. Included are a special supplement of tax ideas. All in all, the book is a watchman over details, a source book for familiar facts, so the creative head of a business may put his abilities to work on building the business rather than on mundane operation.

•

THEORY AND PRACTICE OF LUBRICATION FOR ENGINEERS—*By Dudley D Fuller, professor of mechanical engineering. Columbia University. Published by John Wiley & Sons, Inc, 440 Fourth Ave, New York 16, NY. 432 pages, 6 x 9 in. Price $10.50.*

Lubrication theory is usually presented in an involved form. But here, at long last, is a book that can be understood by both the student and the practical production man or engineer.

Unlike the usual writer on lubrication, Prof Fuller avoids differential equations. Instead, he substitutes graphical solutions. And yet he has covered both the hydrodynamic and hydrostatic theories in lubrication and backs them up with many examples and problems so the reader can obtain either proficiency in the subject or a quick solution to an engineering problem. In addition, he has added a great deal of data that should be most useful to engineers in extending their comprehension of

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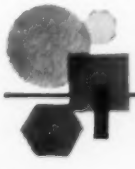

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lubrication and the possibilities for better solutions than have been reached in the past in respect to many kinds of machinery.

This book is definitely not a "low-level type" that has little in it. Actually, it portrays expert knowledge of the field and how to teach the essentials of the subject to others. For Prof Fuller was introduced to lubrication by one of the great investigators and practical experts in the field—the late George Karelitz, one-time professor of mechanical engineering at Columbia, manager of Westinghouse's Marine Engineering Div, etc. From that early association, Prof Fuller was encouraged to success in the same field, including active work with ASME committees and other groups interested in the subject. One of the great values of his book is that, from experience, he is able to show the limitations of theory as well as the probable advantages.

•

AVIATION FACTS AND FIGURES—*Published for Aircraft Industries Association of America Inc, by Lincoln Press Inc, 1143 National Press Bldg, Washington 4, DC. 103 pages, 5¾ x 8¾. Paper bound. Price $1.*

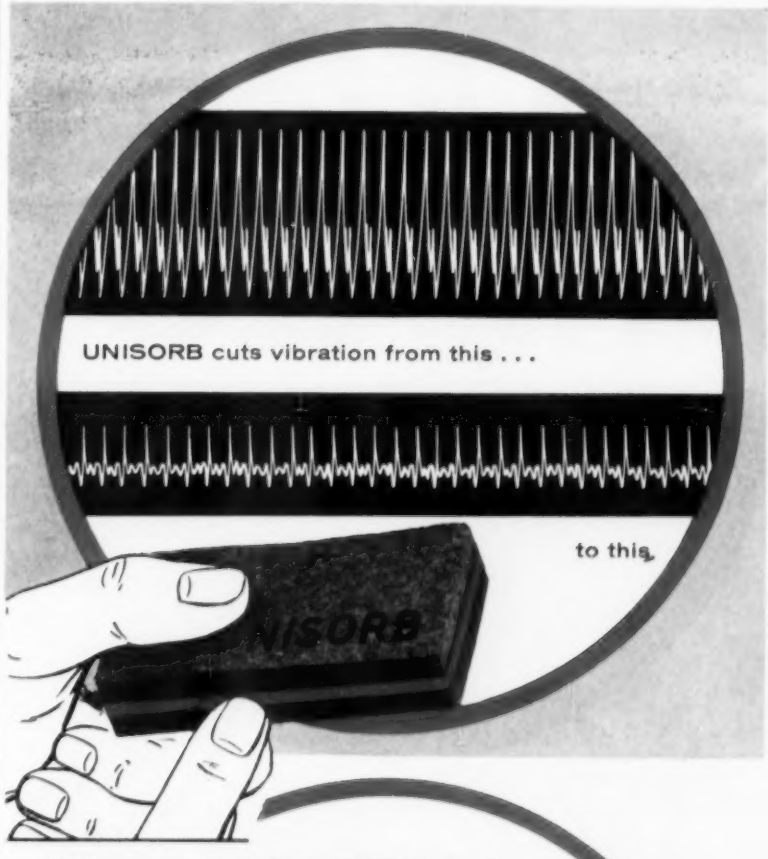
If you have any question of a statistical nature about the aircraft industry of the US, you will be able to find the answer in this book. Its 11 chapters record statistically and textually all the pertinent facts about US air power and the industry which creates it. Included are: production and facilities, labor, military aviation, airlines and transportation, utility aviation, helicopters, aircraft exports, training, and research and development.

This new (4th) edition is a goldmine of facts and figures gathered from absolutely reliable sources and will prove invaluable to those to whom such information is often of vital importance.

•

ELECTRONICS IN INDUSTRY—*By George M Chute, professor of Electrical Engineering, University of Detroit. Second edition. Published by McGraw-Hill Book Co, 330 W 42 Street, New York 36. 431 pages. Price $7.50.*

Basic is the word for this textbook; it assumes no prior knowledge of electronics on the part of the reader, and goes into industrial electronics from scratch. It also covers existing equipment: controls, relays, servo-



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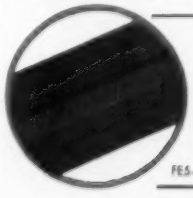

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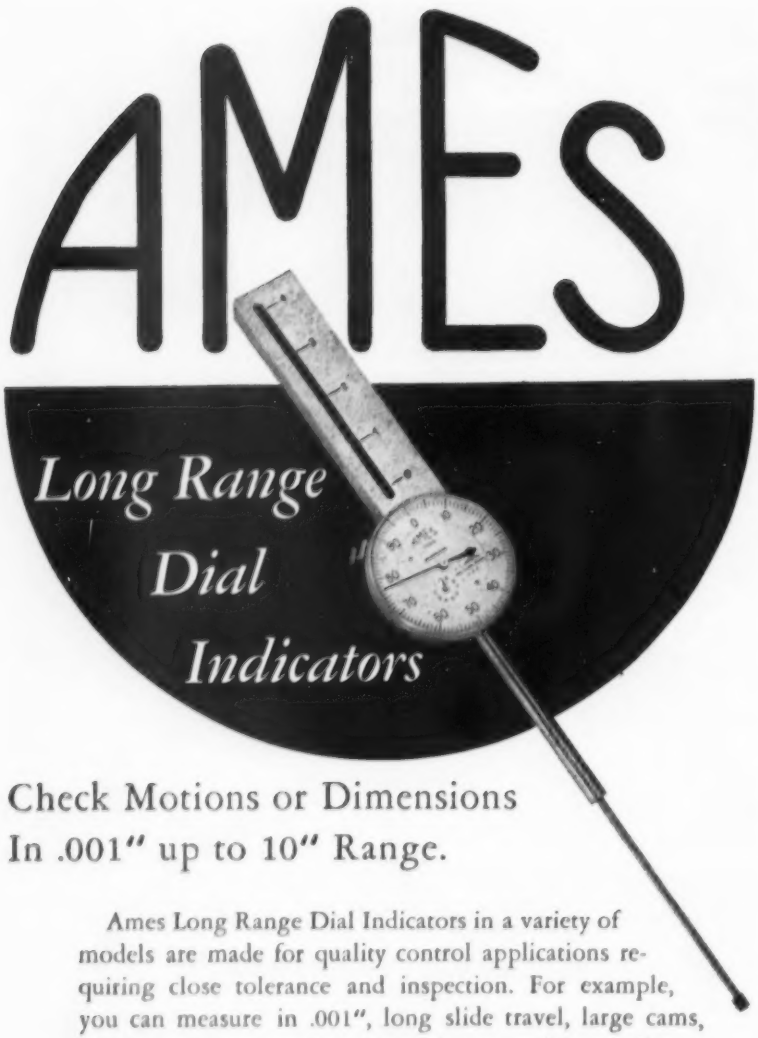

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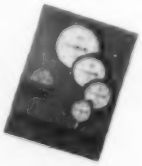

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mechanisms, power supplies, and the like, but does not go into advanced design. It's therefore a good book for almost anyone—maintenance man, foreman, engineer, superintendent—who wants to know the fundamentals about industrial electronics. It doesn't cover communication, and it leaves out complex mathematics.

This edition has been revised so it may be used in a survey course by a technical institute; it was originally designed for study in an evening course.

It starts out with vacuum-tube fundamentals and ends up with transistors, covering current control, electric-welding control, light and heat relays, and servomechanisms in between. There is plenty of information for general industrial use.

•

INDUSTRIAL ARTS ARC WELDING—*By William A Sellon. Published by The James F Lincoln Arc Welding Foundation, Cleveland 17, Ohio. 56 pages, 5½ x 8½ in. Paper bound. Price 25¢ in USA, 50¢ elsewhere.*

Arc welding is still a new subject in many industrial arts schools and may present teaching problems that, while actually minor, appear quite difficult. To answer these problems, the author, a welding instructor and ass't professor of Industrial Arts, Ohio University, tells why and how welding can be taught as a unit, and how it can be incorporated in different types of shops.

This is not a text or instruction manual, but rather an introduction to the subject for administrators, teachers, and students. The equipment and teacher training needed, and the various methods of teaching are discussed. A special chapter deals with safety precautions, and there is an excellent bibliography of texts, references, aids, and project material.

STANDARD AND SIMPLIFIED DRAFTING PRACTICE—*Published by American Machine & Foundry Co, 261 Madison Ave, New York 16, N.Y. 56 pages 8½ x 11. Free on request on company letterhead.*

Simplified drafting practice is receiving considerable attention, and its pros and cons are still widely debated. Many of the objections spring from an incomplete knowledge of what is involved, and a study of this new book should put the quietus on many of the opponents.

It starts with a speech given on the subject by J H Bergen, AMF Standards Administrator, before the American Society for Engineering Education. Then it gives the details of AMF standards on drafting room practice and simplified drafting. Considerable emphasis is placed on the use of simplified practice as a supplement to conventional practice, rather than as a replacement. The student must be taught standard practice before shifting to simplified practice.

There are dollars to be saved by adopting the new system, provided it is properly understood and applied, and no chief draftsman can afford to pass up this opportunity of becoming familiar with the technique.

•

HOW TO FIND A BUYER FOR YOUR INVENTION—*By V D Angerman, editor & publisher, Science & Mechanics Magazine. Published by Science & Mechanics Publishing Co, 450 E Ohio St, Chicago 11. Size 5 x 7½ in. 186 pages. Price $2.95.*

This book makes a lot of sense. It's full of reasonable and fact-based advice that should prevent featherbrained inventors from wasting their own time, and should help inventors with something of value avoid many of the pitfalls in getting a good idea going.

There are many stories of what has happened to inventions in the past, which also makes interesting reading, and which illustrate points about caution, being practical, timing, the value of secrecy, protecting the invention, and other factors.

One point is especially interesting: According to a survey by *Science & Mechanics*, the cost of applying for a patent on a fairly simple mechanical device runs $300 to $500, including costs for a patent lawyer and government fees. This, alone, will discourage many inventors who cannot or don't dare invest that much

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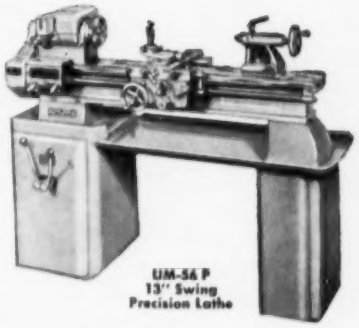

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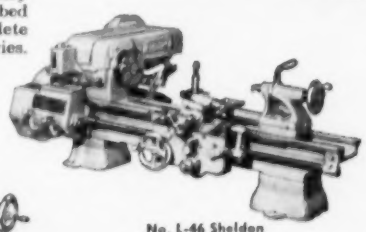

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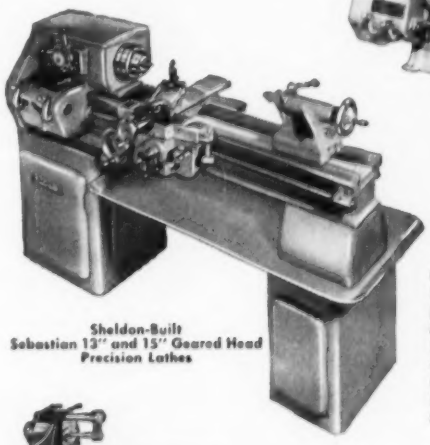

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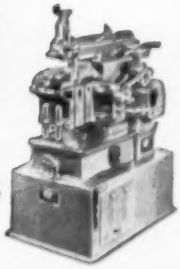

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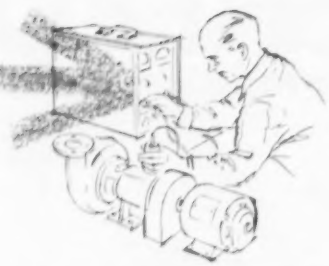
3

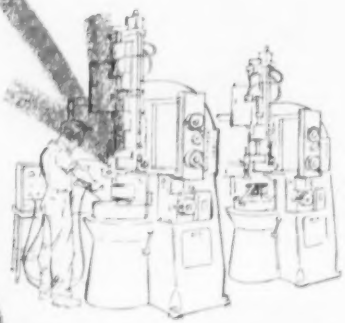


CHECKS MACHINERY OPERATION AND CONDITION — measures permissible vibration and balance tolerances.

WAYS YOUR COMPANY CAN BENEFIT using portable

IRD

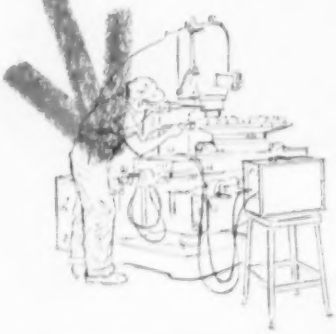
vibration analyzers



FAST TROUBLESHOOTING — quickly pinpoints part causing vibration.

No matter what your product or process, IRD vibration analyzing and portable balancing equipment can help you make it better . . . and at less cost.

Hundreds of manufacturers are utilizing IRD vibration analyzing equipment as a fundamental in their plant programs to attain greater production precision, efficiency and quality on machine tools; smoother operation and longer life on pumps, motors, blowers, generators, gyros and all types of rotating equipment.



DYNAMICALLY BALANCES, "IN-PLACE" — without costly tear-down.

Write today for an *in-your-plant* demonstration

Perhaps you have machinery that's operating a bit rough, right now. We'd be happy to have an IRD Sales Engineer demonstrate on your equipment. Just write or phone. No obligation of course.

IRD

vibration analyzers

International Research and Development corp | 802 thomas lane, columbus, ohio

on the chance they may later be able to sell the invention.

Included is a list of some 140 manufacturers with brief descriptions of what kind of inventions they might consider. It's a short list, but may help an inventor figure out who he might approach; possibly some other company not on the list.

Whether it's simply an idea, a publishable item, or a real invention, this book may help in making it practical and profitable.

•

ARC-WELDED MACHINERY CONSTRUCTION IN MILD STEEL—*By A G Thompson. Published by British Welding Research Association, 29 Park Crescent, London W 1, England. 36 pages, 7¼ x 9¾. Paper bound. Price 6 shillings (85¢).*

Written with remarkable clarity and simplicity, this booklet is a practical guide to the design of welded machine elements. It gives reasons for using weldments, defines the terms used in describing welds, and gives details of the various types of welds and the static and fatigue stresses imposed upon them. Factors to be considered in reducing costs, and many cost-cutting ideas are presented directly and concisely. There are a great many illustrations, clearly drawn, that express exactly the author's meaning and leave nothing to the imagination.

While this is definitely not a textbook, it should prove extremely valuable to designers and draftsmen, and can well serve as a practical teaching and study manual.

•

FIRE & ACCIDENT LOSS CONTROL INDEX AND DIRECTORY—*Published by Loss Control Associates, 629 Oakmont Drive, Plattsmouth, Nebr. 1200 pages. Price $48.50. Supplemental service $17.50 per year.*

A new information service for use in fire and accident control fields, this volume consists of an extensive index of subjects pertaining to such control and lists the publications in which information may be found. It also includes a guide that calls to the user's mind the various considerations and preventive actions necessary on each subject, and a directory listing publications referenced in the index and guide sections, showing their availability, procurement source, and price.

The book includes over 10,000 subjects and 50,000 references. A supplemental service will keep the volume up to date.

No other word in the language of screw threads applies to so many tap elements as "concentricity", the lining up of the various elements with the axis. Concentricity is to a tap what a foundation is to a building.

Taps with all elements concentric can be expected to operate smoothly, efficiently, economically. Without concentricity in just one element no amount of modifying or compensating for error will make them work the way they should.

That's why at "Greenfield" this $64 word is as common as "plumb" to a builder.

IF IT CAN BE MEASURED **GREENFIELD** *MEASURES IT*

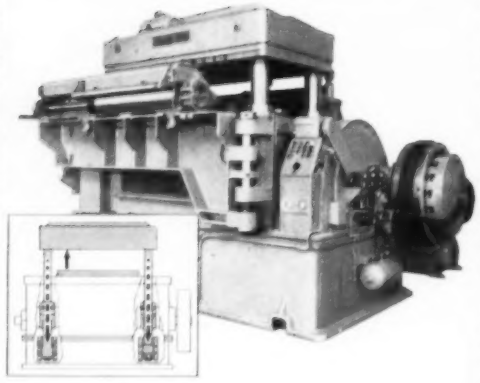
GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

NEW

HENRY & WRIGHT DOUBLE CRANK DIEING MACHINES

Here's a new H&W development designed to reduce the unit cost of metal stampings. Engineered to bear loads encountered in long progressive dies while maintaining precision registration of punch and die, H&W's Double-Crank assembly also offers you greater flexibility in ratio of die bed to press capacity. Thus you can: (1) form larger parts with lower capacity machines than before possible; and (2) handle stampings requiring high pressures with greater precision and longer die life than before. Write today for complete details.

NOW! For Extending Economies of Progressive Stamping . . .



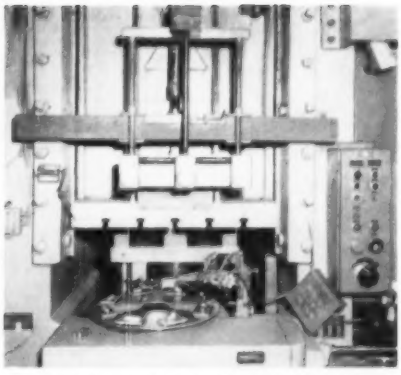
New 350-Ton Dieing Machine. Insert drawing shows advantages of new Double-Crank assembly.

NEW

V & O ONE-TO-ONE FEED-O-MATIC

Now you can equip your geared pneumatic clutch presses with V & O Feed-O-Matics and gain all the advantages of precision automatic feeding – increased production, greater personnel safety and precision quality control. The Feed-O-Matic for geared presses is driven directly from the drive shaft on a one-to-one ratio. Mechanical fingers of the Feed-O-Matic lift parts up, over, and into the die for precise placement. High cost tools can be used with less fear of breakage and longer die life than before. Write today for complete details.

NOW! For Faster, Safer Feeding with Geared Presses . . .



The Feed-O-Matic® is simple and self contained, well enclosed, but highly accessible for servicing.

Presses and methods that automatically reduce costs

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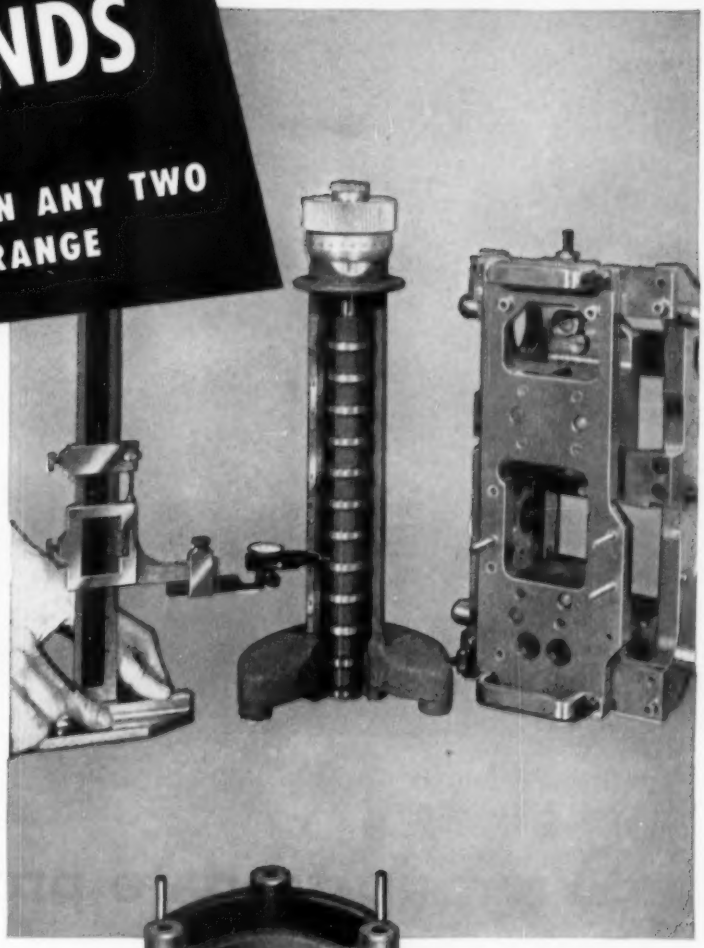
SETTING TIME:

10 SECONDS

ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



Cadillac PLA-CHEK

SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

Designed for easy portability and extreme ruggedness, this 12" Cadillac PLA-CHEK takes little more than 10 seconds to set! Permits surface plate checking and inspections nearly 5 times faster than by ordinary methods.

And, accuracy is assured! Between any 2 points in the 12" range accuracy is guaranteed within .00005".

With a reverse checking plate, a height-gage indicator is easily set for checking the underside of parts. Use of inside micrometers, telescoping and internal cylinder gages gives this gage added versatility. Send coupon TODAY for complete details!

To increase the usefulness of the 12" Cadillac PLA-CHEK Gage, without sacrificing portability, this 6" precision-made riser may be used—upping range to 18".

Cadillac

GAGE COMPANY

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MAIL THIS COUPON FOR COMPLETE DATA

CADILLAC GAGE COMPANY
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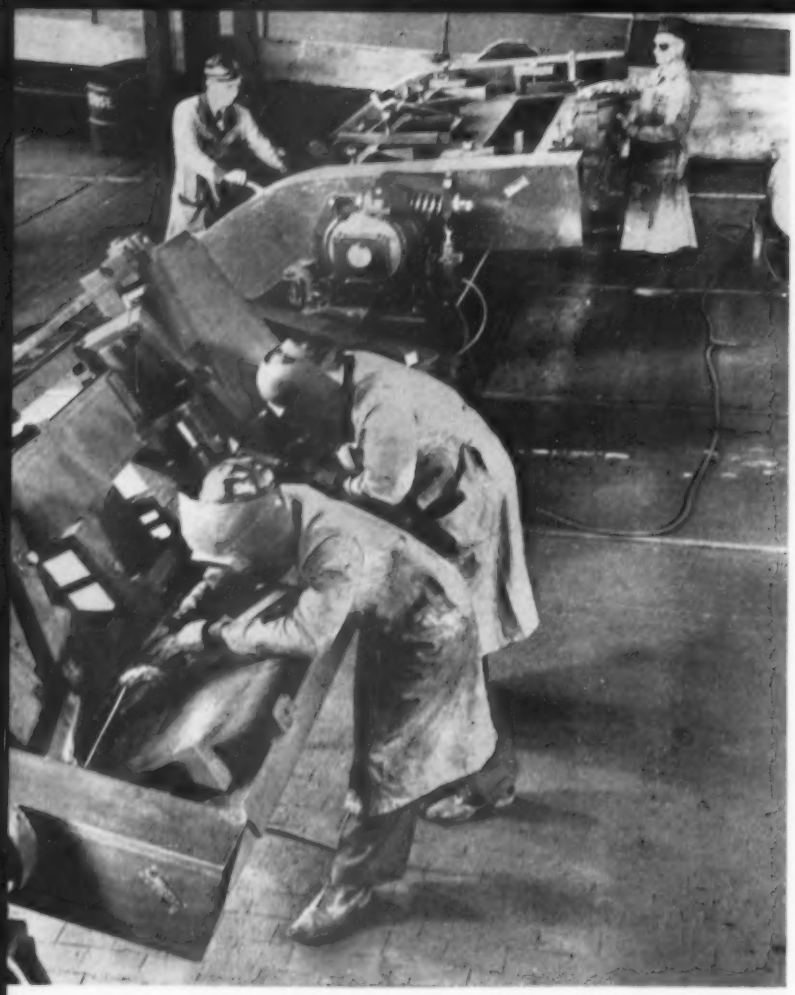
Without obligation please rush complete information on the Cadillac PLA-CHEK Gage line to:

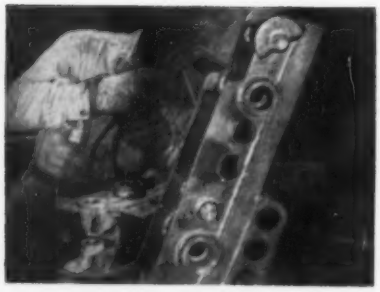
Name_____

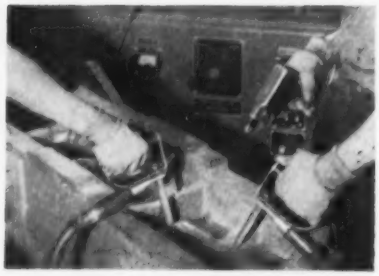
Company_____

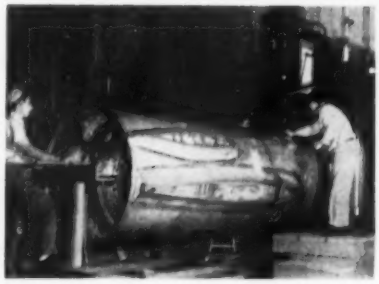
Address_____

City_____ Zone____ State_____









Want up-to-date production ideas?

on INSPECTION · TESTING · QUALITY CONTROL

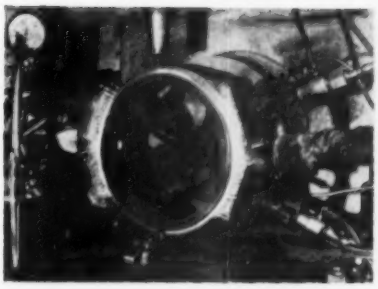
...look in Sections E and F—AM's 1957 Production Planbook and

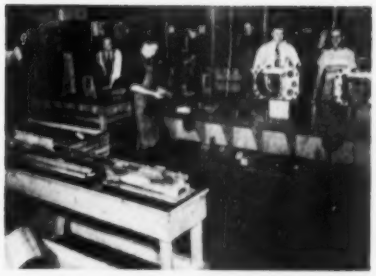
New York—A treasure of production "Nuggets"—solid, useable ideas from previously published articles in AM—covering inspection, testing, quality control, assembly, heat-treat, and finishing practices and equipment will be found in Sections E and F of AM's 1957 Production Planbook and Buyer's Guide Issue. Section F will also cover latest developments in welding and portable tools.

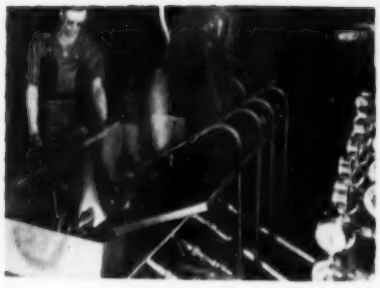
New inspection techniques and devices; testing ideas and policies; steps to be taken to control quality before, during and after production and assembly; assembly developments including welding, brazing and joining practices—and such automated assembly ideas that do not appear elsewhere; latest heat-treat ideas and equipment; and product finishing techniques and apparatus, all condensed into single quickly digested ideas will compose the two sections. AM page numbers and issue dates in which the full article appeared will be supplied for easy reference by subscribers wanting more detailed information, diagrams, drawings or illustrations.

11 Fact-packed Sections

Outlined above are only two of 11 sections making the American Machinist 1957 Production Planbook and Buyer's Guide Issue Metalworking production's first "packaged planning" reference volume. Titles of the other sections are shown at right. With this essential working tool, exclusive to *American Machinist*, readers may plan 1957 production, adopt latest Metalworking techniques and locate sources of supply for all the production equipment, materials of manufacture, parts and supplies they require.







1957 OUTLOOK

MANAGEMENT, PERSONNEL A

MACHINING B

TOOLING C

PRESSWORKING, MOLDING, CASTING D

INSPECTION, TESTING, QUALITY CONTROL E

ASSEMBLY, HEAT-TREAT, FINISHING, (ASSEMBLY INCLUDES WELDING & PORTABLE TOOLS) F

MATERIALS, COMPONENTS G

MATERIALS HANDLING, SERVICES H

PRIZE IDEAS, REBUILT EQUIPMENT I

BUYER'S GUIDE J

• ASSEMBLY • HEAT-TREAT • FINISHING?

Buyer's Guide Issue, due Mid-November, 1956

Sections, as in the past, will be thumb-indexed for easy reference, and the issue will open flat for complete visibility and convenient use. A special mailing carton is provided.

New Buyer's Guide

Major new feature of the 1957 Planbook will be a Buyer's Guide section listing nearly 7000 sources of supply under almost 1500 headings, cross referenced for rapid, easy use. Headings for everything used by Metalworking production—from basic materials to electric motors, from production equipment to bearings and gears—will be developed, with suppliers' names and addresses listed under them.

Shop-Oriented Reference Issue

Production "Nuggets"; Developments to Watch in '57—vital planning checklists; Manufacturers' Free Literature lists; and the new Buyer's Guide feature form a single-issue reference volume usable indefinitely to stimulate "How-to-do-it", "What-to-do-it-with" and "Where-to-buy-it" ideas for greater production at less cost, better quality control, and more profitable operations.

FASTER SAFER HANDLING

OF LARGE AND SMALL SETS

SUPERIOR

PRECISION ALL STEEL

DIE SETS

Large Sets No Longer Need Be Blocked . . . Small Sets Can Be Lifted Without Sliding.

Three features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment. Write for FREE 24 page Catalog on Superior Die Sets and Supplies.

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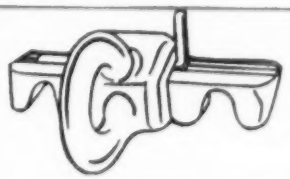
Milwaukee, Wis.—Mitchell 5-6027 and Plainville, Conn.—SHerwood 7-2701

SUPERIOR STEEL PRODUCTS CORP.
2754 S. 19th ST., MILWAUKEE, WIS.

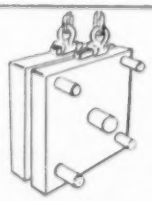
SAFETY FLANGE

protects fingers by providing roomy gripping space on either side of the die shoe. This flange may be mounted flush or on the edge of the die set and is welded in place. There is no extra charge for this valuable safety feature.



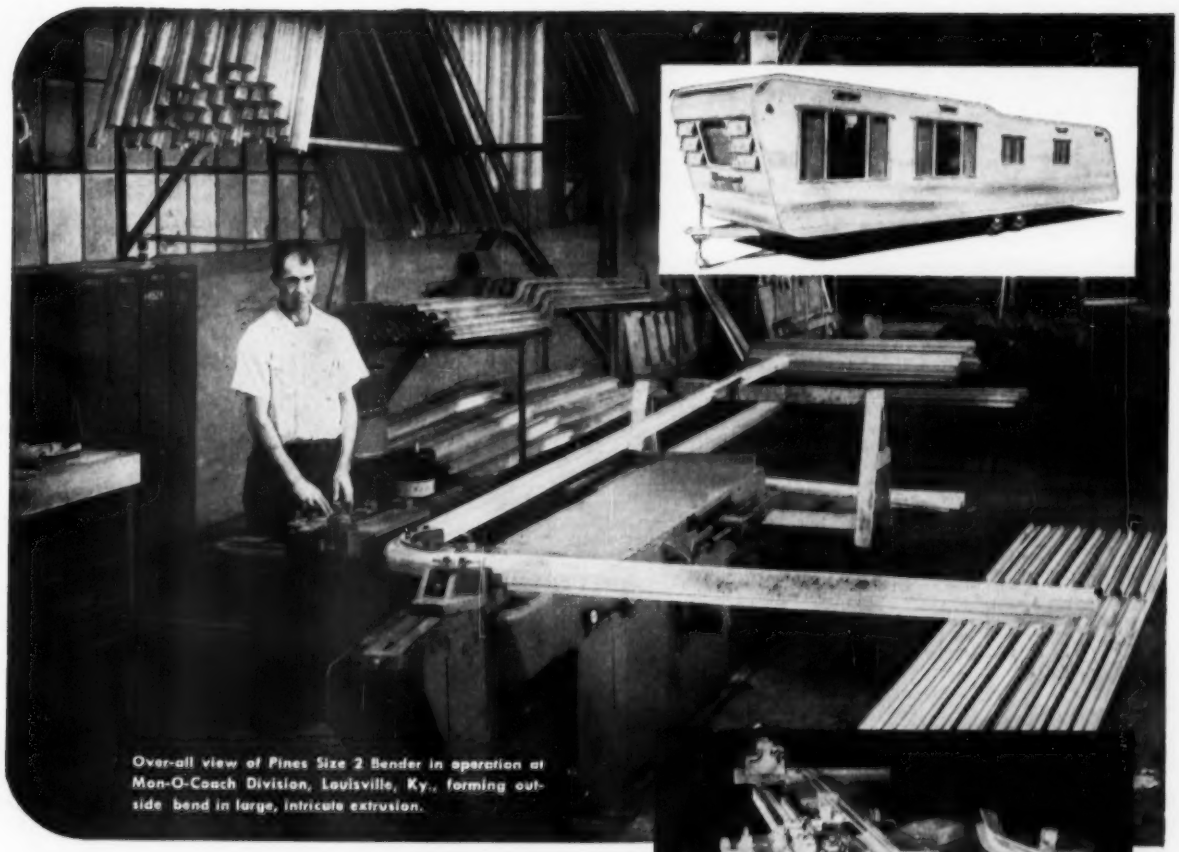
LOCK-JAW LIFTING DEVICE

removes the danger of handling large die sets. Heavy steel components of this device are welded in place forming an integral part of the die set. They are positioned to insure proper balance when the set is lifted by either chain fall or crane.



E-Z LIFT SLING CHAIN

is especially designed to fit the flanges of the die sets. Male jaws attached to the sling fit quickly into place for immediate lifting. There is no need for screw clamps, eye bolts, or lifting lugs.



Over-all view of Pines Size 2 Bender in operation at Mon-O-Coach Division, Louisville, Ky., forming outside bend in large, intricate extrusion.

▲ View of tooling for making offset bend in opposite direction. Two plug-type mandrels support inner walls. Smooth, neat bends are formed at a bending arm speed of 6.0 r.p.m.

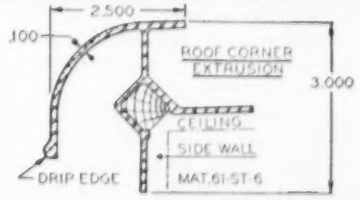
PRODUCTION BENDING ALUMINUM EXTRUSIONS THE "PINES-WAY"

The new, luxurious Mon-O-Coach Mobile Home, manufactured by Mon-O-Coach Division, Ironwood Trailer Coaches, Inc., Louisville, Ky., is a marvel in modern metals engineering. It features all-aluminum structural members which are now cold formed and shaped accurately by production bending methods. Previously, many of the bends were formed by slitting and hand-bending a section, then re-joining the slotted section by welding. Today, a Pines Size 2 Production Bender handles these jobs fast and efficiently.

Slitting and Welding Operations Eliminated

All curved sections are now cold formed in a single operation, including an offset bend in an opposite plane in one of the most ingenious extrusions probably ever developed for the automotive industry. Shown in drawing, this large unique extrusion, incorporating a ⅝" wood section, is a top corner section which serves as a means of fastening top, sides, and front panel members together. Tooling by Pines forms neat, smooth bends without excessive distortion or wrinkling, completing the piece with the wood section in place. Previous slitting and welding operations are eliminated.

▼ Cross-section of Mon-O-Coach's intricate, top corner extrusion. Hollow center incorporates ⅛" wood section installed before bending—serves as a means for fastening wall studdings.



Write FOR MORE DATA

If you would like more data on production bending of aluminum extrusions the "Pines-Way", write for free copies of "Pines News". Or ask for a Pines engineer to call and assist you with any production problem.

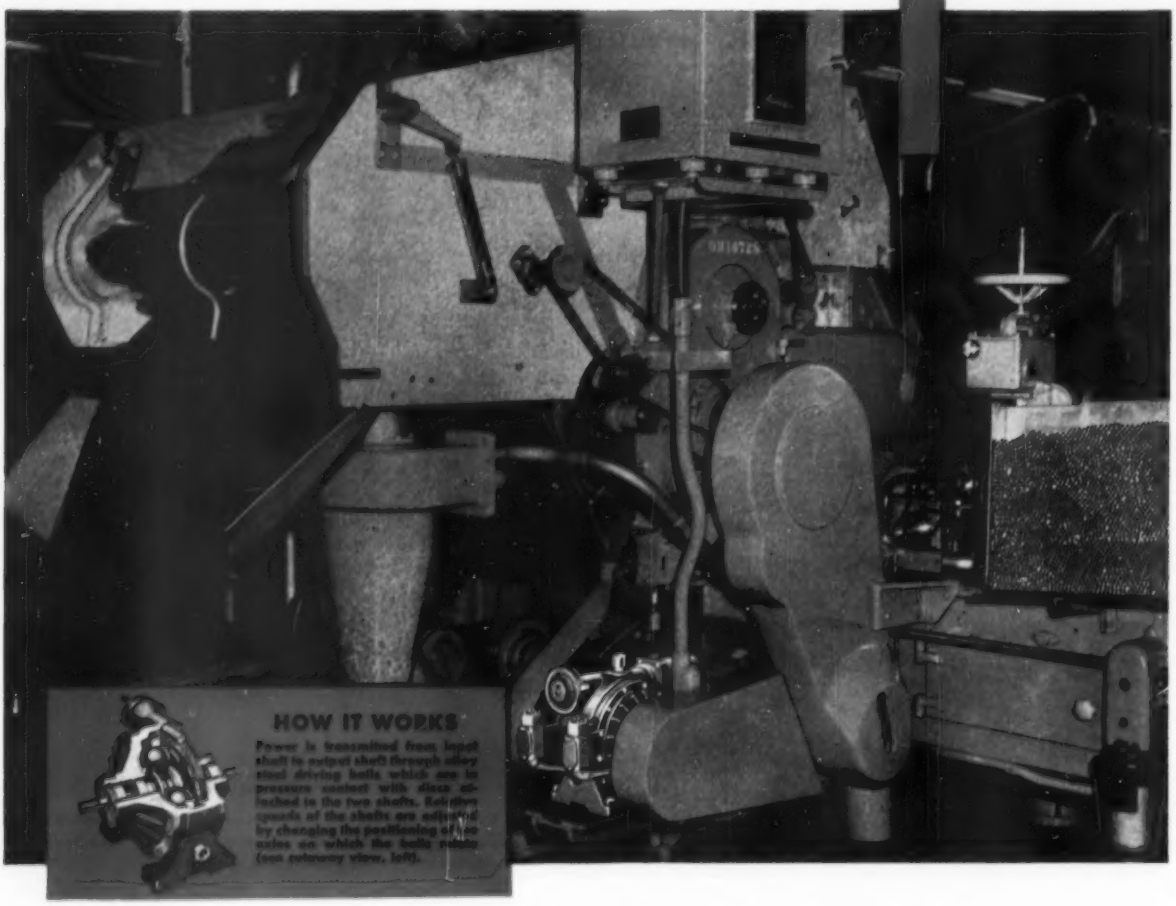
PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery · 672 WALNUT · AURORA, ILLINOIS

PRODUCTION BENDING · DEBURRING · CHAMFERING MACHINERY

AccuRay electronic brain gets muscle power from Cleveland Speed Variator

The electronic control mechanism of this cigarette machine, known as the AccuRay cigarette gage controller, built by Industrial Nucleonics Corp., Columbus, Ohio, employs Cleveland Speed Variator size 4K4, driven at 1200 rpm input.



NATIONALLY famous for checking and controlling the making of Chesterfield cigarettes, AccuRay depends on a Cleveland Speed Variator for the delicate job of adjusting the tobacco feed rate in response to impulses from the gaging mechanism.

Being infinitely variable, the Cleveland Speed Variator gives stepless speeds over a full 9:1 range — from ⅓ to 3 times input speed. Output speed on this application is adjusted automatically by a regulating motor mounted on the Variator — but could be regulated manually or by remote controls of other types.

Available in eighteen standard types and sizes, the Cleveland Speed Variator offers these major advantages: 1. An extremely compact unit with input and output shafts in line and rotating in the same direction; 2. Almost any input speed up to 1800 rpm can be used — either clockwise or counterclockwise rotation; 3. Rated for constant horsepower output over a 9:1 range, or for constant output torque with a 6:1 range; 4. Infinitely variable over the entire speed range; 5. Rapid response to speed change, precise adjustment, and accurate maintenance of speed settings; 6. Long life and minimum maintenance due to absence of belts or complicated linkages; 7. Ample bearing support for overhung pulleys on either input or output shafts.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.

THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3254 East 80th Street, Cleveland 4, Ohio

Sales Representatives in all major industrial markets • In Canada—Peacock Brothers Limited

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

SENECA FALLS MODEL "LN" LATHE IS EQUIPPED AND AUTOMATED FOR SPECIALIZED PRODUCTION JOB

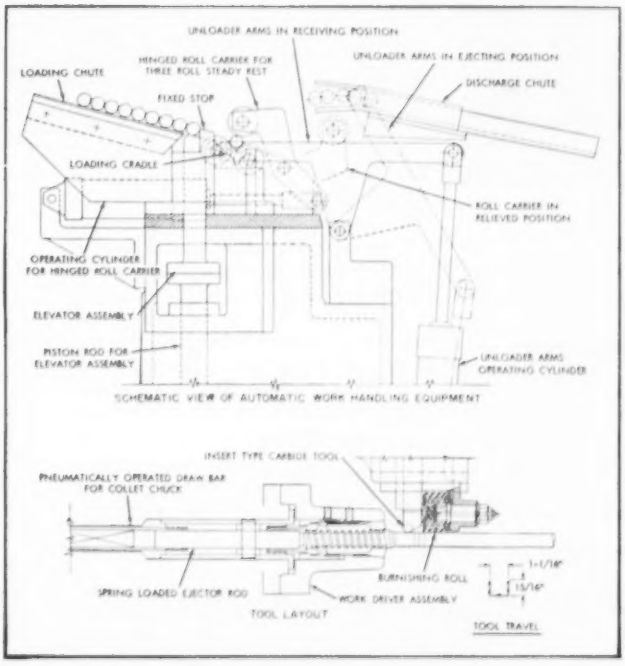
Seneca Falls Model "LN" Automatic Lathe designed with standardized units including a "PACKAGED" automatic loader and ejector mechanism.

PROBLEM: To remove welding flash from worm shaft assemblies on a high-production basis.

SOLUTION: A Seneca Falls Model "LN" Automatic Lathe was equipped with certain standardized units to provide a specialized high-production machine at substantial savings in initial cost and lead time.

Red hot welded parts are delivered by a conveyor, which joins the loading chute shown in the line drawing illustrating the automatic work handling equipment. The work piece is held and driven in a collet chuck and supported by a hinged three-roll steady rest. A carbide tool on an overhead slide removes the hot flash and is followed by a burnishing roll which smoothes the junction of the welded parts.

The entire loading, machining and unloading operations are entirely automatic; however, push button controls are installed for the manual operation of each movement. The loading cycle cannot get out of time since the automatic sequence is controlled by a system in which each movement is initiated by the completion of the preceding movement. A production of 275 pieces per hour is readily obtained with this equipment.


UNLOADER ARMS IN RECEIVING POSITION
LOADING CHUTE
HINGED ROLL CARRIER FOR THREE ROLL STEADY REST
UNLOADER ARMS IN EJECTING POSITION
DISCHARGE CHUTE
FIXED STOP
LOADING CRADLE
ROLL CARRIER IN RELIEVED POSITION
OPERATING CYLINDER FOR HINGED ROLL CARRIER
ELEVATOR ASSEMBLY
PISTON ROD FOR ELEVATOR ASSEMBLY
UNLOADER ARMS OPERATING CYLINDER
SCHEMATIC VIEW OF AUTOMATIC WORK HANDLING EQUIPMENT
INSERT TYPE CARBIDE TOOL
PNEUMATICALLY OPERATED DRAW BAR FOR COLLET CHUCK
BURNISHING ROLL
SPRING LOADED EJECTOR ROD
WORK DRIVER ASSEMBLY
TOOL LAYOUT
TOOL TRAVEL

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MILLING MACHINE ARBORS, ADAPTERS, ARBOR SPACERS AND BEARINGS

Hardened and ground to high standards of accuracy and quality.

These products are built by long established, reputable West German manufacturers, and tested for performance to American standards. Immediate delivery from New York City stock at low competitive prices.

Also available:

- *Multi purpose vises*
- *Tapping attachments*
- *Lathe mandrels*
- *"Wille-Grip" keyless drill chucks*
- *Large variety of machine tools*

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All parts hardened and ground. Simplicity of construction insures trouble-free operation.

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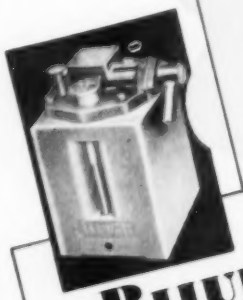
From the *American Machinist* Library of *Tips for Top Shop Men*

WATCH always for the jobs you *can't* do—well. Specialized equipment and specialized knowledge outside may be worth the extra cost in reduced scrap and headaches. Sometimes the price may be less too—and it costs nothing to get an estimate.

YOUR SILENT PARTNER



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AUTOMATIC LUBRICATION

HELPS YOU
- effect real savings in your own plant
- design savings into the equipment you make

Hand oiling is costly! It wastes time and money . . . steals valuable production hours . . . means extra down-time, fire risk, repair bills, replacement parts and causes product damage from excess lubricant.

But there's a way to end all this waste and worry. A Bijur Automatic Lubrication System never forgets a bearing . . . bearings never are thirsty for oil, never flooded. Lubrication is continuous, exactly right. All the hazards of hand oiling are banished—*automatically!*

Bijur Systems are custom-engineered for machinery used by practically all industries. Every bearing receives a clean supply of oil at the right time . . . automatically and correctly metered to suit its individual needs . . . while the machine is running! Whether for new equipment you *buy*, or machines you *build*, insist on Bijur. It's better—*by design!*

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HYDRAULIC AND
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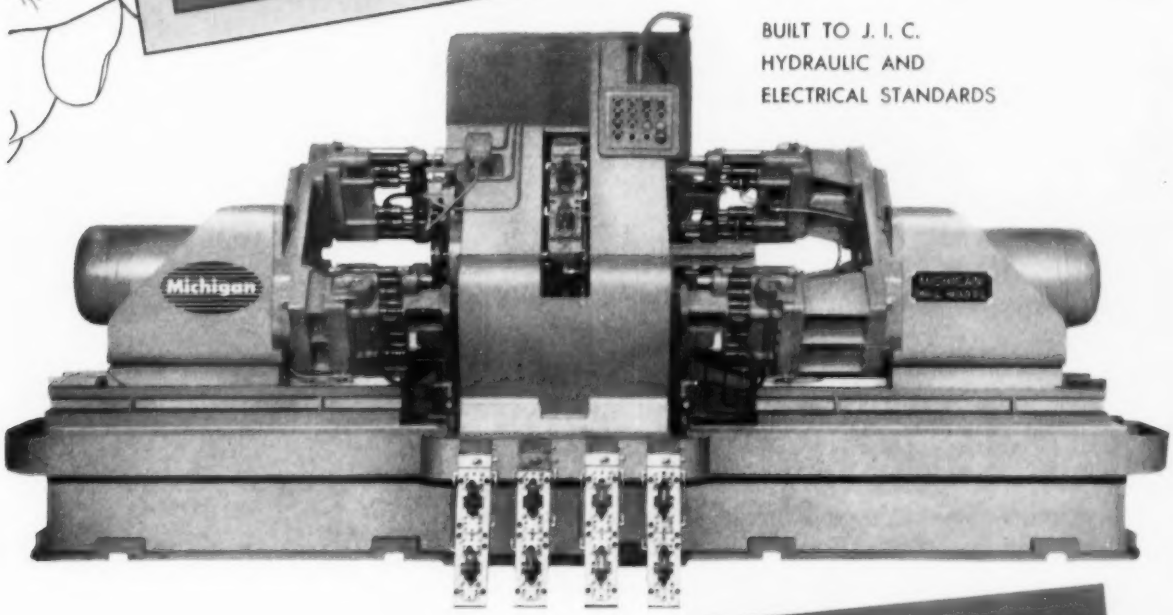

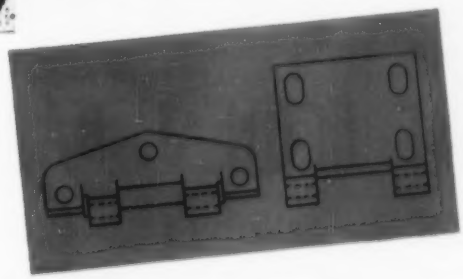

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- Way type hydraulic feed.
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- Trunnion type fixtures power operated.
- Interchangeable fixtures for any kind and size hinge.
- Only a minimum amount of tooling required for model changeovers.

For Faster, More Economical Production

We also invite your inquiries regarding our full line of tapping units, and index tables, manual and automatic.

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engineers and manufacturers of production machines and drilling equipment

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Many impregnating jobs previously requiring hours by vacuum-pressure methods are now being done in a few minutes in the

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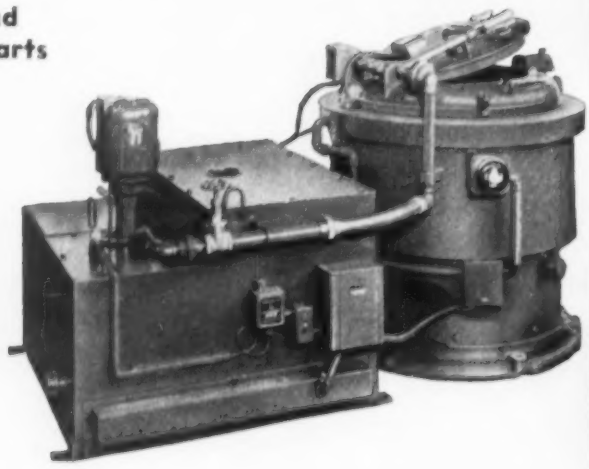

- Cleans outer surface in same operation—eliminates dripping and messy handling
- Thoroughly saturates, by DIRECTIONAL IMPREGNATION, materials heretofore considered impenetrable
- Requires only a fraction of the space usually occupied by vacuum tanks—easily cleaned

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"Pioneering Centrifugal Machinery Since 1848"

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Tough Metalworking Problems? Try this . . .

For the answers to questions of classification and selection of types of steel and non-ferrous metals, machining, heat-treating, forming, cleaning, joining, finishing . . . everything from raw stock to finished product . . . all in a single 288 page, 8¼" x 11" booklet—*"How to Work Metals"* . . . a *must* for every metalworking plant and shop. Convenient, easy-to-use, combining two Special Reports "How to Work Steel" and "How to Work Non-Ferrous Metals." Concise, complete, liberally illustrated. $1.00

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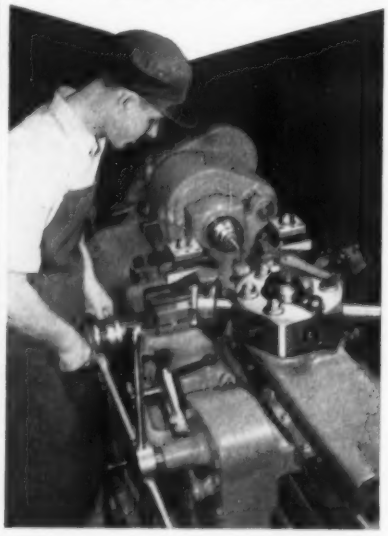
A Better Value

SOUTH BEND

2-H TURRET LATHES



South Bend 2-H Turret Lathes have the stamina for exacting close-tolerance work, rigidity for producing fine finishes and ample power for smooth performance. Gear box provides 48 power feeds each for turret ram, universal carriage and double tool cross slide. Such a wide selection of feeds insures all-job range. Where can you find a better turret lathe value? Write for information on this fine machine.

SPECIFICATIONS

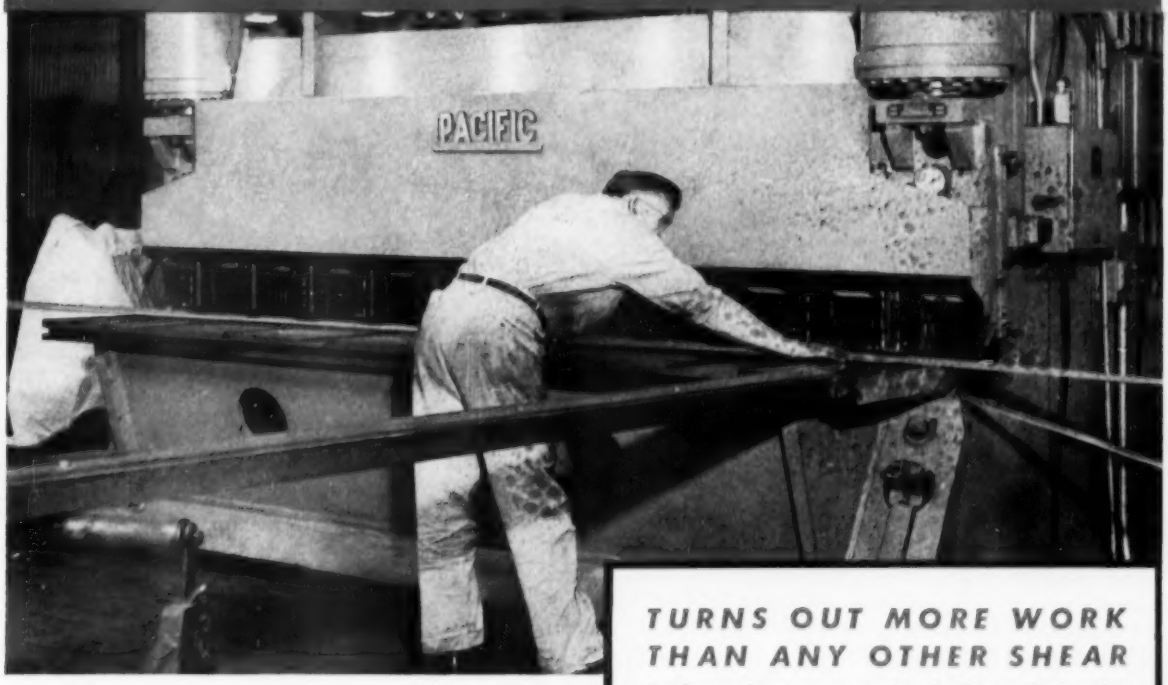
Spindle Hole—1⅛". **Collet Capacity**—1". **Swing**—16¼". **Spindle Speeds**—20 to 945 r.p.m. **Turret Feed**—5⅞". **Dia. Turret Holes**—1½". **Thread Range**—4 to 224 per in. **Motor (2-speed)**—2, 1 h.p.

▶ **$3350** Illustrated, less electrical equipment and tooling, f.o.b. factory. Low down payment. Only 3¼% annual interest on original unpaid balance due.

SOUTH BEND LATHES

SOUTH BEND 22, INDIANA

PACIFIC HYDRAULIC SHEAR cuts sheets or heavy plate noiselessly, accurately, at lowest cost



. . . knife blade lasts longer, shear cannot be damaged by overload

Lower cost shearing can be yours with this remarkably efficient shear that eliminates shock, the main cause of blade damage and wear. Pacific Hydraulic Shear gives you speed, accuracy, safety, economy and long, trouble-free performance. It cuts soft aluminum or polished stainless without marking . . . it cuts narrow strips or trims fine edges from plates or sheets. At a single setting of the blade clearance it cuts any piece between 20 gauge sheet and full capacity. Gap type shear cuts pieces far longer than the shear length. Simple hydraulic system eliminates troublesome maintenance of mechanical shears. For production or piece work, Pacific Hydraulic Shear can be the biggest profit-making tool in your plant.

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TURNS OUT MORE WORK THAN ANY OTHER SHEAR

Pacific speeds set up, measuring, handling and the other necessary operations that take up 95% of cutting time. It is a one-piece, welded steel structure that provides the rigidity necessary to shear heavy plates accurately. Straight-line downward pressure from 2 hydraulic cylinders keeps the shear from twisting or deforming under heavy loads. Slide ways are exceptionally long and heavy so that blade clearance is precisely maintained under heavy loads. Unique hydraulic back gauges controlled from the front rapidly move into place and can be inched slowly into the exact setting within thousandths of an inch. Blade clearance is adjusted in less than 5 minutes by calibrated screw in front of machine. Hydraulic hold-down provides positive gripping of work piece. Pressure is adjusted in seconds to match any work.

Pacific Shear is operated by movable foot pedal placed wherever most convenient. Dual control pedal available. Shear cannot be damaged by overload. Operator cannot possibly get his fingers or hands under the knife. Movement of shear either in inching or cutting is instantaneously responsive to the foot control pedal so that the blade can never get out of control.

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Variac® motor speed controls

. . . "We use them with Confidence"

Variac Motor Speed Control mounted on Gisholt No. 4 Superfinishing Attachment.

Speed control apparatus used with superfinishing and high-speed, metal-polishing equipment must be of the best for this is delicate, exacting work. Such speed controllers must be capable of smooth control over a wide range of speeds, and operation must be as dependable and trouble free as possible.

General Radio Variac Motor Speed Controls were designed for just this kind of service . . . and an increasing number of machine-tool manufacturers are finding this out. One such concern, the Gisholt Machine Company, now uses this motor control as standard equipment on all its Superfinishing Attachments to simplify speed changes on workpieces with varying diameters.

Type 1701-AK VARIAC Motor Speed Control, For 1/15 hp Shunt-Wound D-C Motors, Mounted on Gisholt No. 3 Superfinishing Attachment.

Motor control is equipped with Speed Control knob and dial, Forward-Reverse switch, On-Off line switch, 0-1725 and 0-3450 rpm switch, Slow-Blow Fuse, and Pilot Light. This compact unit is readily mounted on bench, wall, shelf, or assembled as an integral part of any machine.

Fifteen other Units from 1/15 hp to 1½ hp are available in both cabinet and stripped-down models. Prices range from $67 to $380. WRITE FOR THE VARIAC MOTOR SPEED CONTROL BULLETIN for complete data.

Leonard Hesse, engineer at the Gisholt Machine Company, has this to say of his Company's choice in motor drives:

"The Variac Motor Speed Control was selected after very thorough consideration with respect to available equipment. It fills our needs well.

"Our prime requirement was that the drive be as reliable in operation as is possible. Low-speed performance was particularly important as our Superfinishing Attachments must be run at very low speeds for extended periods.

"In conclusion, the compactness, simplicity and ruggedness of this particular piece of equipment would seem to make it useful in any kind of shop, and under all sorts of conditions. We feel we can use it on all types of Superfinishing applications with confidence — this includes single-piece set-ups as well as production runs."

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The G-R Variac Motor Speed Control is a motor drive which easily meets stringent specifications for performance and dependability. Advantages and Conveniences . . .

OPERATES D-C MOTORS FROM A-C LINES: plugs into ordinary 115 or 230-volt lines, converts this power to d-c, and provides all the advantages of d-c motor operation.

WIDE SPEED RANGE: at constant output torque.

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DYNAMIC BRAKING: on all larger models.

NO ELECTRON TUBES: selenium rectifiers make for ruggedness and reliability, require no warm-up time.

PERFECTLY SMOOTH CONTROL: from few rpm to rated speed.

LONG LIFE: with minimum maintenance; built-in overload protection prevents motor burnout.

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RESULTS: Elimination of runout and wobble—controlled backlash—quiet running, long life gears. **Improved quality at lower cost!**

More and more manufacturers are using this method to produce precision gears.

Average installation: Under $1,000. **Dia. Range: 1/8" to 2 5/8"**

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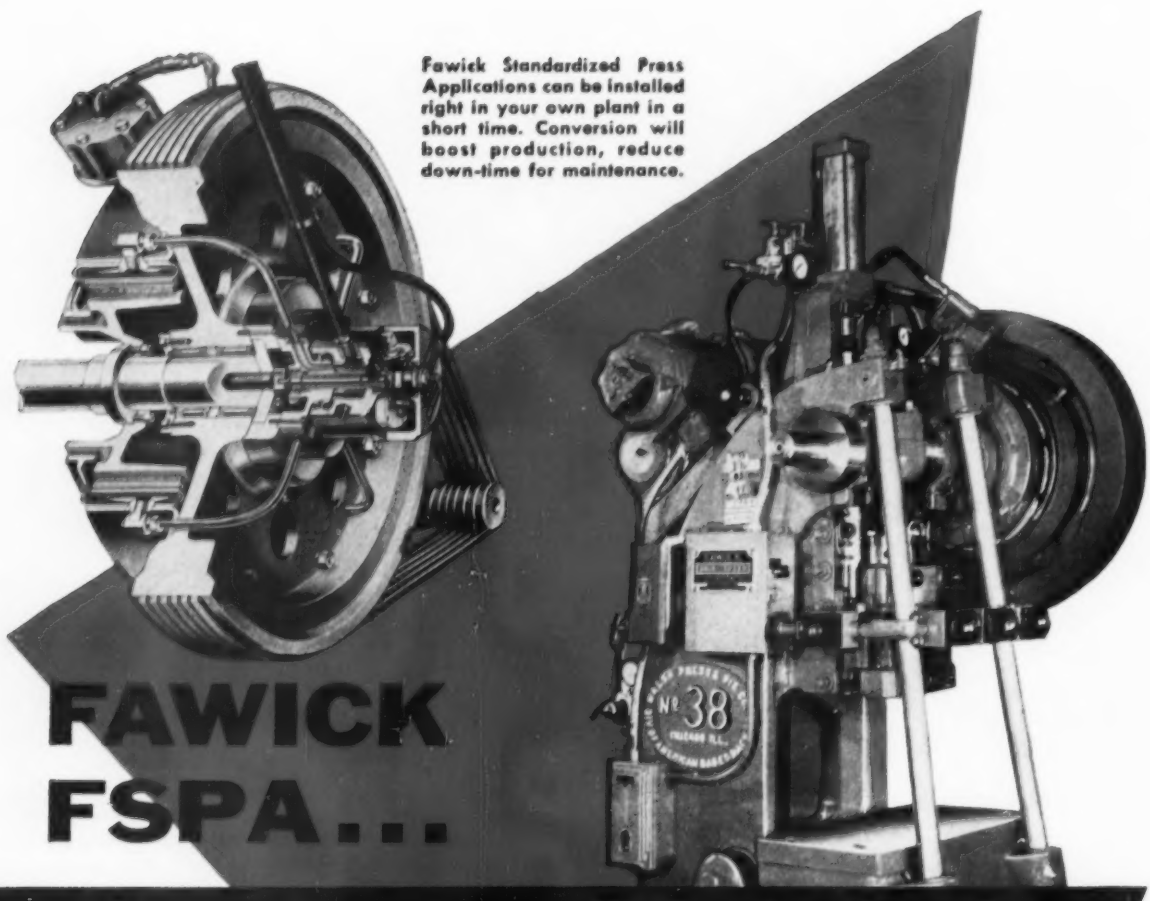
Fawick Standardized Press Applications can be installed right in your own plant in a short time. Conversion will boost production, reduce down-time for maintenance.

FAWICK FSPA...

worthy partner for a Hi-Production Press



Walsh No. 38 Hi-Production 38-ton O.B.I. Punch Press equipped with Fawick CB Airflex Clutch, CS Brake, Timing Rotorseal and High-Speed Controls.

■ Walsh Press & Die Co., division of American Gage & Machine Co., has 50 years of experience in building dependable power presses for the metalworking industry. Many Walsh Presses are now equipped with FAWICK Standardized Press Applications for increased production. This is made possible by these proven advantages of FAWICK components: CB Clutch-CS Brake combination—faster action, minimum service; Timing Rotorseal—simple operation, space-saving design; High-Speed Clutch Controls—adaptability for many types of operation.

All presses—new or old—will benefit from conversion to modern pneumatic power transmission with FSPA. For additional information contact your nearest FAWICK Representative or the Home Office in Cleveland today.

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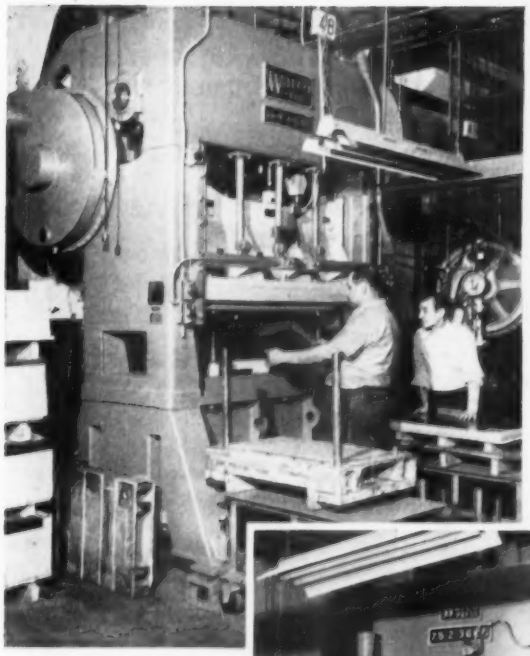
INDUSTRIAL CLUTCHES AND BRAKES

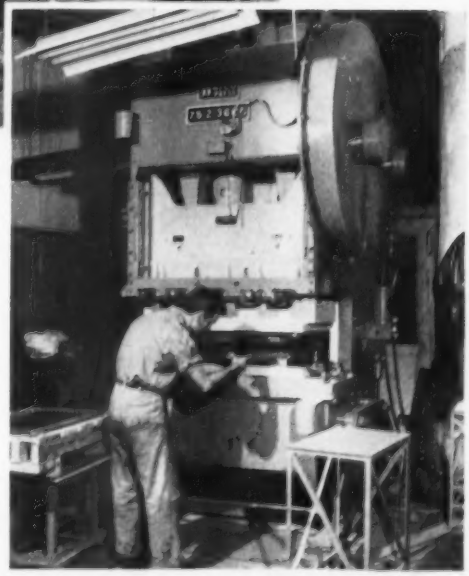
The highly popular Tudor Tru-Action Electric Football Game. Tudor also makes electric baseball and horse racing games.

"Warco's a winner!"

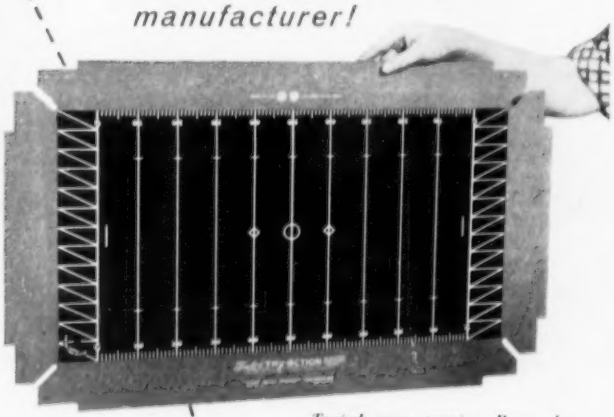
says leading metal game manufacturer!



Press Foreman Andrew Harris watches as press operator Andrew Amodeo operates 100-ton Warco Crank Press.



Salvatore Cordero puts flanges on stamping with Warco 75-ton Crank Gap Press.



Typical game stamping. Pressmark must be accurate, clean and not disturb lithography.

"We've tried quite a number of different presses in our shop—and in our books, Warco is a winner," say officials of the Tudor Metals Products Corporation of Brooklyn, N. Y., one of the nation's leading manufacturers of metal games.

"Clean and neat of design, they perform with businesslike efficiency, with a minimum of maintenance. We like what we have seen, and certainly must give them an inside track when considering new press equipment."

If you haven't as yet talked with a Warco user, why not let us put you in touch with one in your area. We know he'll convince you that Warco will win for you, too.

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Warco PRESSES

The Federal Machine and Welder Company

WARREN, OHIO

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Wolverine

Heavy Duty

QUICK ACTION TOGGLE CLAMPS

Extra CLEARANCE
Extra SPEED

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HARDENED PINS & BUSHINGS

at all bearing points, in the popular C-100, CQ-1100, and CQ-800 series Toggle Clamps.

Rugged construction—drop forgings, cast steel and solid bar stock.

Wolverine Toggle Clamps also available in several types and sizes of Standard Action and Push Action units.

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WRITE for DESCRIPTION and PRICES

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"BEST $1306 WE EVER SPENT!"

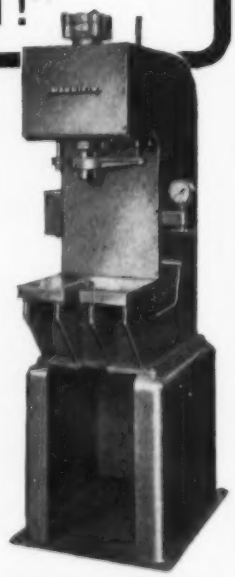
That's the price of this 5-Ton HANNIFIN Press*

A lot of production men have made such comments about this versatile little hydraulic press.

They like the way you can adjust it to the exact force you need for each job, all the way from 1 ton to 5 tons. The backstroke is adjustable, too, so the ram just clears the work on any job. Fast-acting controls. Prompt delivery from stock.

WRITE. Complete information and prices on the Hannifin line of 1- to 10-ton Hydraulic Presses will be sent on request.

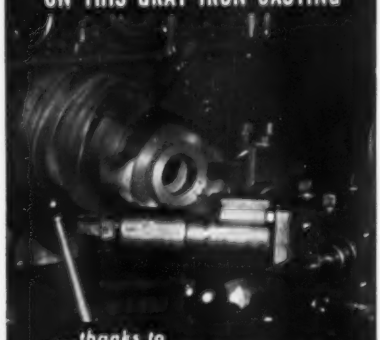
*Price complete with motor and starter F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



HANNIFIN

Hannifin Corporation, 517 S. Wolf Road, Des Plaines, Illinois

UNIT MACHINING COST CUT 17% ON THIS GRAY IRON CASTING



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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE... because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

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Century has more than 50 years' experience in engineering DC motors. For information on any motor application, call or write your nearby Century District Sales Office or Authorized Distributor.

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FLANGES THE DUCT *with Amazing Speed!*

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MAKES PERFECT DRIVE-CLEATS TOO!

The ONLY tool that does both. A complete drive cleating tool . . . no set-up time . . . no adjustments. Handy to take out to the job when not needed in the shop. Turns idle time into production time. Flanges any square duct up to 20 gauge. Quickly pays for itself in time, material and labor savings.

No. 12 Smith's Cleat Bender
(12" wide) . . $49.80*

No. 18 Smith's Cleat Bender
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PERFECT DRIVE CLEATS fit the duct without the use of a screwdriver.

TREMENDOUS SAVINGS in erection time and labor.

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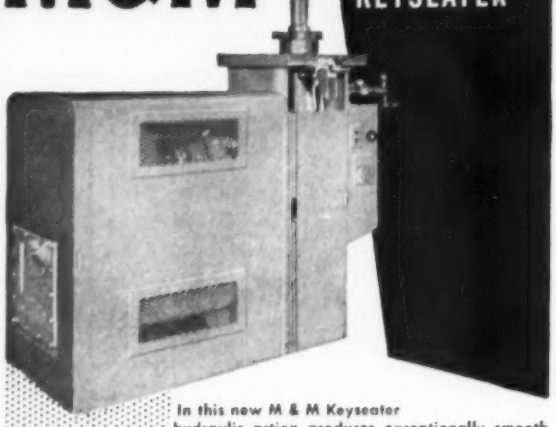
1132 Elizabeth Avenue • Waukegan, Illinois

M&M NEW HYDRAULIC KEYSEATER



In this new M & M Keyseater hydraulic action produces exceptionally smooth performance. Cutter stroke and feed are automatically controlled, tool relief is also automatic. High degree of accuracy is assured. Available in a wide range of sizes. Rugged construction features insuring long life are based on 67 years experience. Mechanical drive keyseaters available for cutting keyways in all sizes up to 5" wide and 60" long. Write for specification folder.

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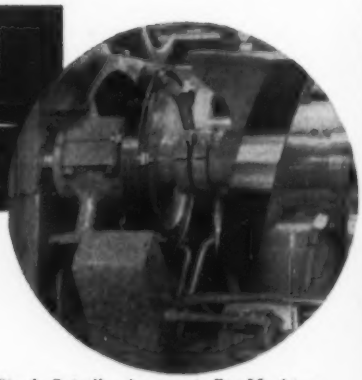

Illustrated is a Cleveland Dialamatic Single Spindle Automatic Bar Machine equipped with a Gusher Coolant Pump.

Model S-P 3

Your Gusher Coolant Pump is always primed and ready to deliver coolant instantaneously. There is no lag — no waiting for the flow to start — and you can easily regulate the volume from a trickle to full capacity.

Pre-lubricated ball-bearings, electronically balanced rotating shaft, and totally enclosed dustproof motor assure you also of long trouble-free life for your Gusher Coolant Pumps.

THE RUTHMAN MACHINERY CO.
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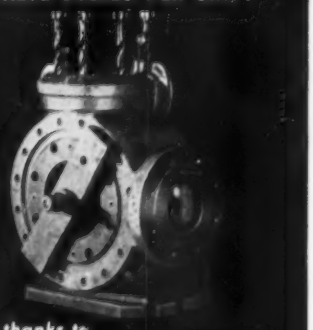
DRILLS 7% MORE GRAY IRON VALVE BODIES PER SHIFT



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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE . . . because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

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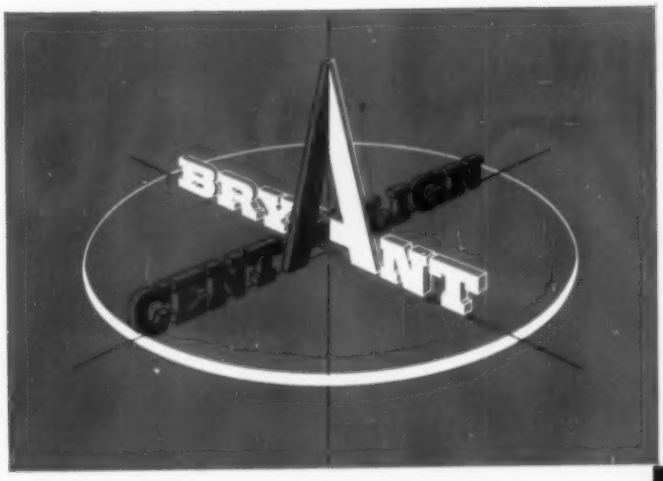
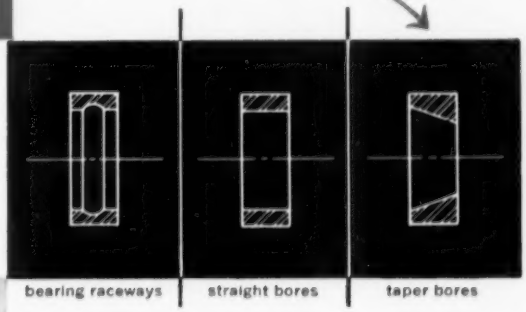


This taper hole, 2 3/4" dia. X 15/16" long, is ground in just 16 seconds, floor to floor.



Get higher production and lower operating costs with the Bryant "Centalign"

Just 16 seconds, floor to floor, to remove .018 stock to close tolerances. One more proof that the "Centalign" will remove stock up to 50% faster than heavier conventional type machines.

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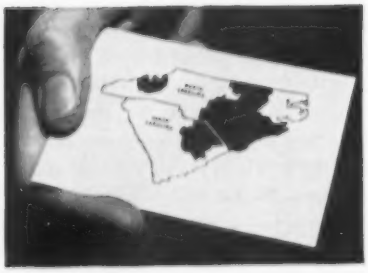

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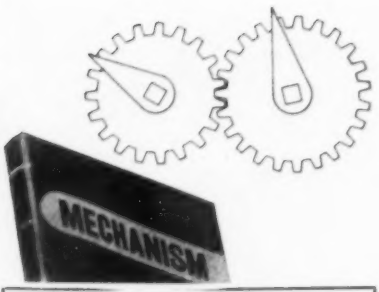

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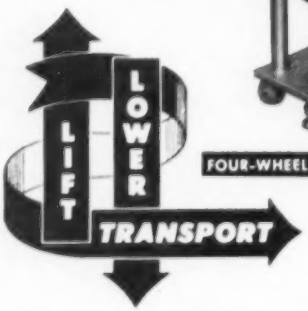

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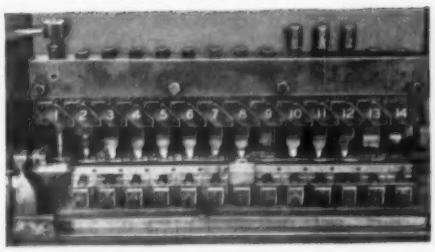
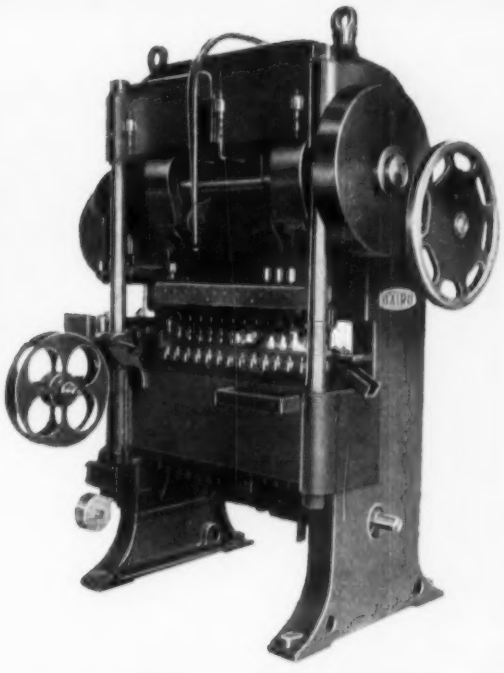


A complete die set with full complement of punches and dies in working position and with transfer in loading position. Note accessibility of all mechanisms and adjustments.



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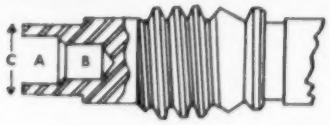

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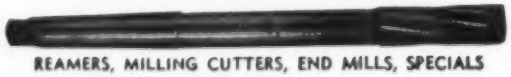

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Technical-ities

By John S. Davey

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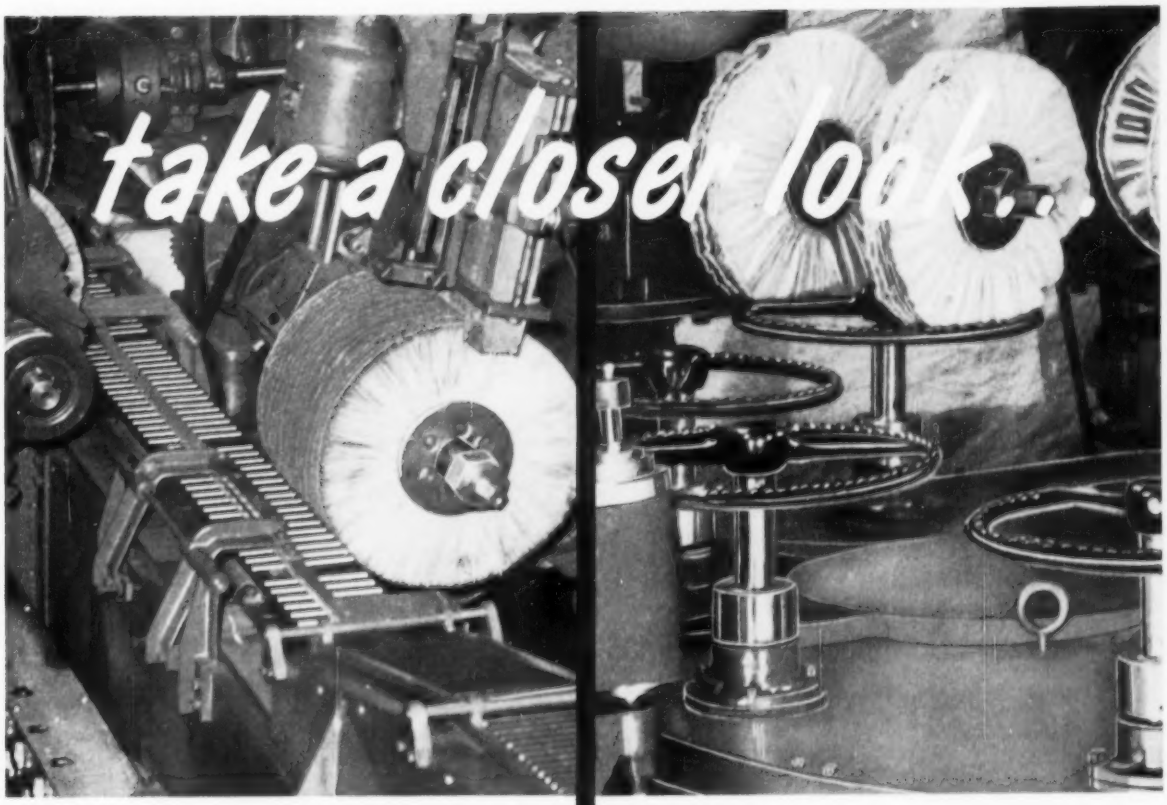

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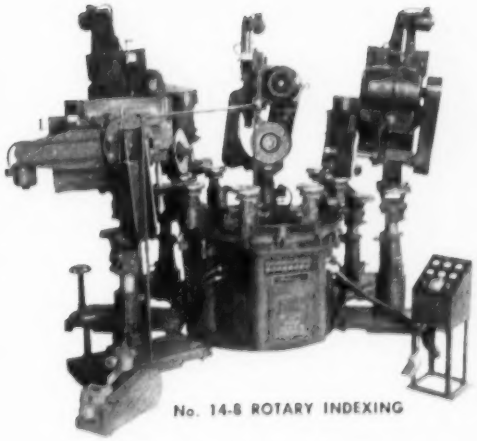

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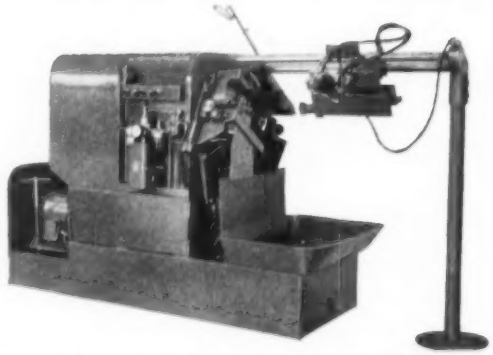

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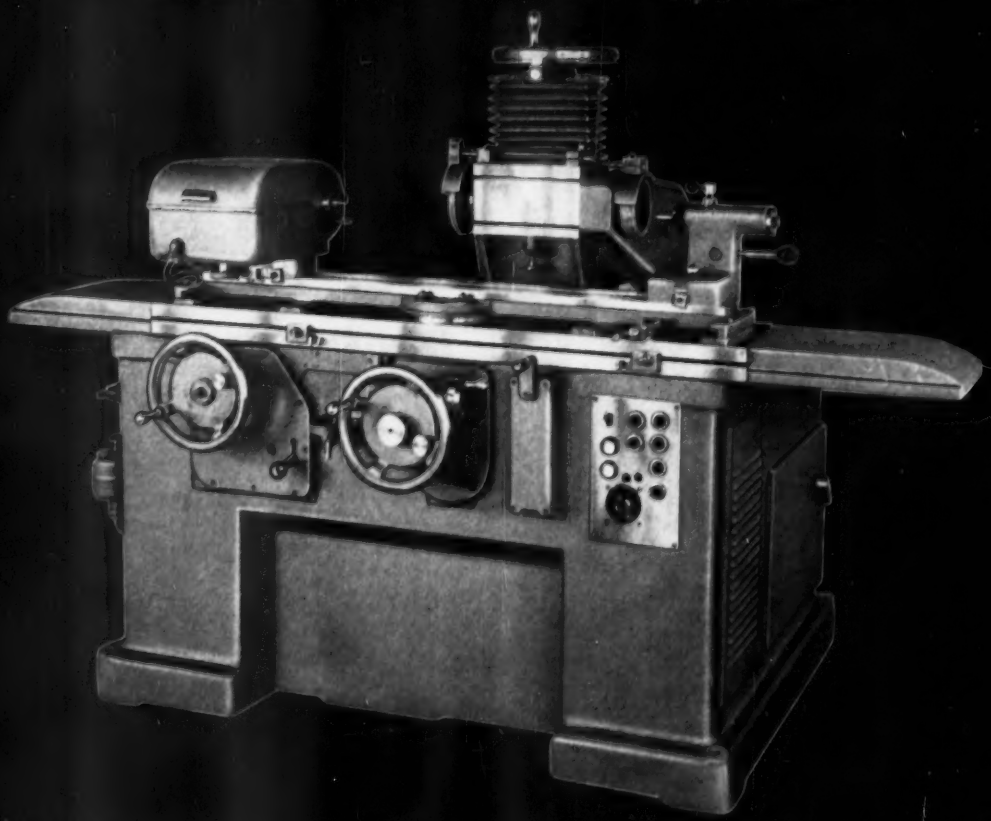

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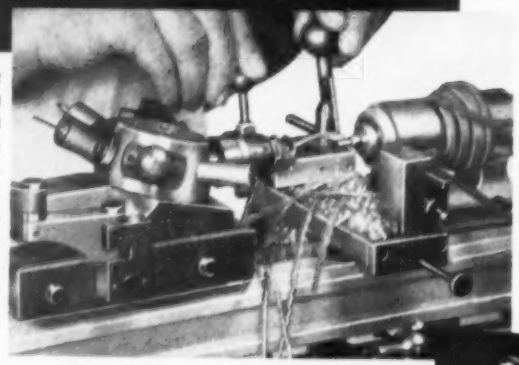

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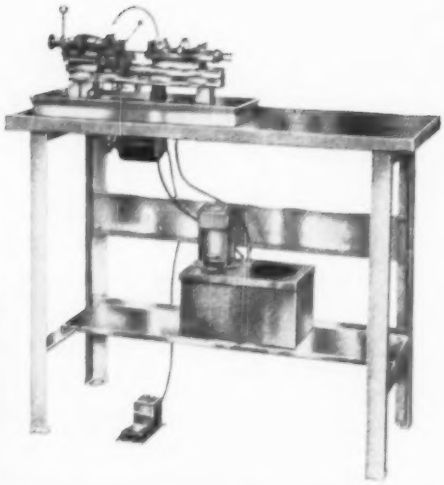

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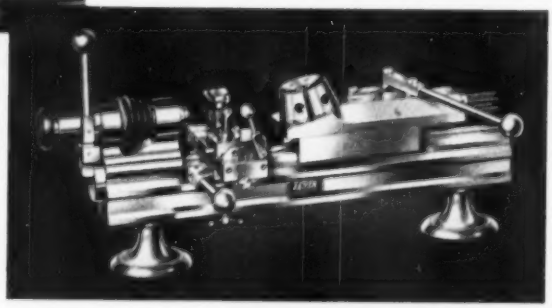

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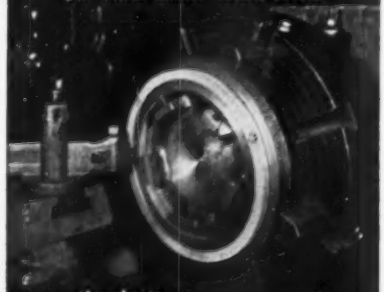

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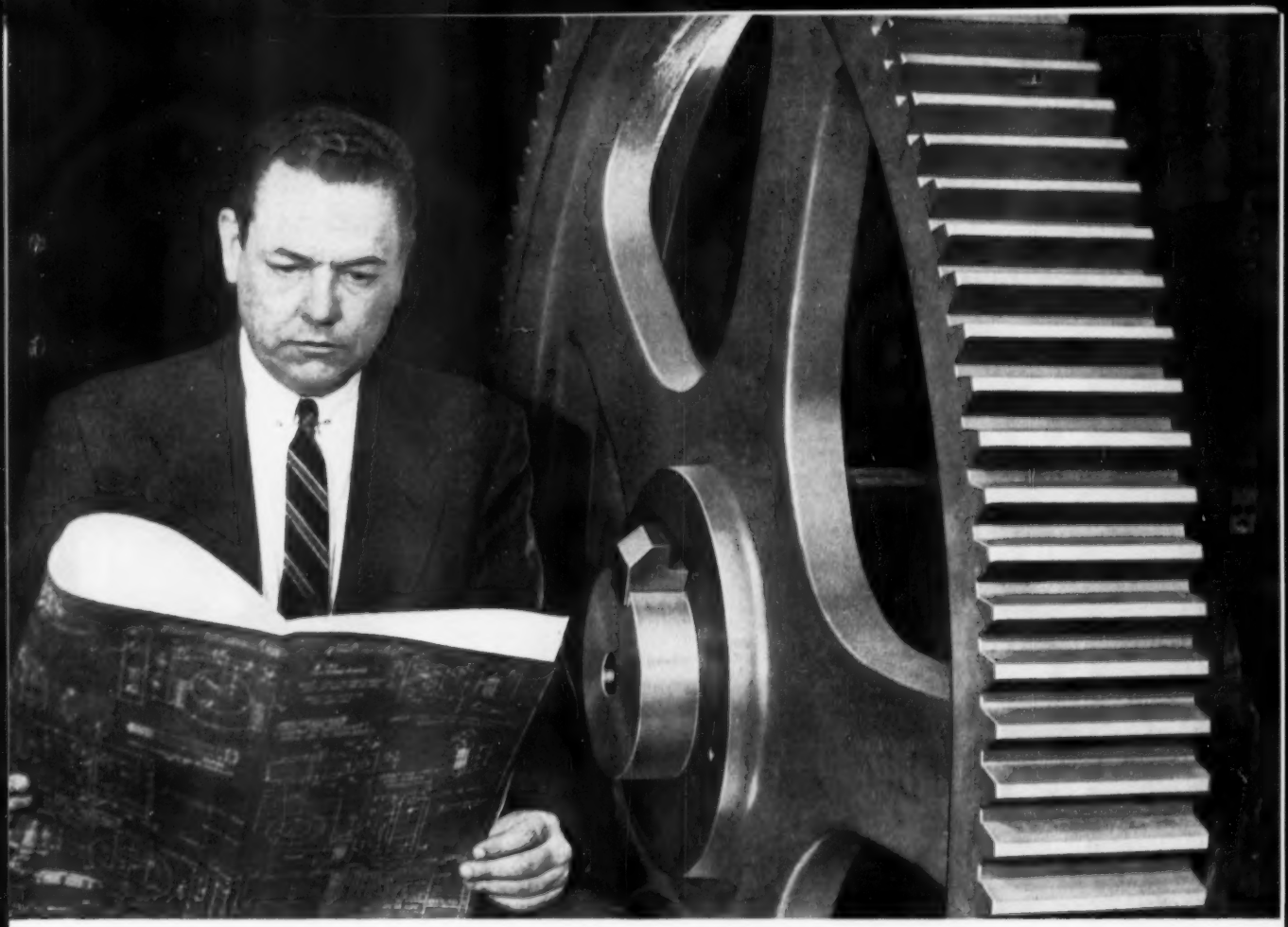

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Moly gives cast iron gears higher strength with toughness and good machinability

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So vote—but don't vote in the dark in this exciting election year.

Listen to what candidates are saying on TV and radio.

Read your newspapers—especially the political news and editorial page.

Talk things out with your neighbors over the back fence and at the filling station on the corner. Take part in the discussion group at your church, club, lodge, or school.

Think about the issues and the candidates—and then make up your own mind. Remember, nobody is in that voting booth but you and your conscience. Step behind that curtain with pride on election day. Then vote as a free American.

VOTER'S CHECKLIST

1. **Be sure you're registered.**
2. **Study the issues and candidates.** Go to rallies. Ask questions. Read the papers. Listen to speeches.
3. **Mark up a sample ballot** in advance. (They are published in the papers.)
4. **Join your neighbors at the polls on Election Day November 6th.**

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You can't vote if you're not registered. You lock yourself out of the polls, unless you're a registered voter. And you and only you can get your name in the Registration Book. When they call the roll on election day, will you be there? Do you know anyone who won't?

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the Surplus Machinery Market

What will the ultimate effects of the steel strike be on the used machinery market? Quite a few dealers figure it this way: if metalworking firms aren't well enough stocked with steel items, they'll cancel any plans they have to increase capacity until they can get back into full production. That means not only loss of used machinery sales but if the buyer's plans called for installation of new machinery, the used machinery dealer will lose out on possible trade-ins.

That isn't the thinking of most dealers, however. The consensus figures it this way: the strike could mean lengthened deliveries on new machine tools, a factor that might switch some buyers to used machinery. And, of course, the inevitable steel price hike is bound to boost the cost of new machine tools—a factor that will make used tool buying more attractive, although most dealers are agreed that higher price tags on new machines mean higher prices on used ones, but to a lesser degree.

Said one used machinery salesman on the West Coast, "Higher steel costs—and costlier new machinery—may mean more business for us, but we're not happy about it. Nobody likes to see prices go up, especially on used machines. We're afraid many buyers of used equipment will be paying more than the original cost of the machine. This has already happened to me. I recently sold a 20-year-old engine lathe, original cost $15,000, for just under $20,000."

Used machinery dealers are afraid, too, that increased demand for used equipment will make it even harder for the dealer to get. Procurement is the No. 1 problem everywhere.

It's the same all across the country: dealer after dealer reports that business is slow—and they don't look for much if any relief until well into the fall. One Midwesterner, for example, says sales are "way down" from first and second quarter levels—he estimates the drop at about 30%. This dealer can't possibly see a pickup of any kind before fall, figures sales will get worse before they get better. Turret lathes, he says, seem to be moving better than any other production machine tools.

Even more pessimistic is the dealer who reports "nothing is moving"—his business is down "at least 40% from the first and second quarter."

Another is a bit more optimistic. A few weeks back, he reported that business was slow. Today he says sales of good quality machines have picked up a little in the last two or three weeks, particularly in production millers. Centerless grinders, which he says were "hot" just a few weeks back, are cooling off and those that are being sold are going at lower prices. This dealer doesn't look for any pickup before fall, probably September or October, but then it'll be a good-sized upswing.

"What hurts today," says one dealer, "is the high price you have to pay to replace a machine in your inventory after you've made a sale—there isn't much profit in selling a rebuilt and guaranteed job for $2000 when you have to turn right around and pay $2100 for another one to replace it in your stock."

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B & S 2B Hi-Speed Plain
B & S 3B Hi-Speed Plain
K & T 2H Plain
K & T 5H Plain
K & T 2HL Swivel Head Vertical
KEMPSMITH #3, Plain 1946
VAN NORMAN #12
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AMERICAN 20 x 72 H.D. Pacemaker, T.A.
LEHMAN 16 x 30 Hydratrol, T.A.
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P & W 14 x 30 Model C Toolroom T.A.
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G & L 25 RT 2½" Table Type Hor.
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TURRET LATHES
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B & S #1—⅝" Wire Feed Hand Screw
B & S #2—1" Wire Feed Hand Screw
GISHOLT #4—2" Bar & Chuck
GISHOLT #5—2½" Bar & Chuck
GISHOLT 3L — 4½" Bar & Chuck — Threading

PRODUCTION MILLERS
CINN. #0/8 Plain
CINN. #0/8 Vertical
CINN. #2—18 R & F Cam Roller
CINN. 4—36 Hydromatic

MISCELLANEOUS
GRAY 36" x 36" x 12' Double Housing Planer—1942
HEALD 47A Borematic Hyd Cross Slide Table
INGERSOLL 42" x 42" x 14' Double Housing Adj. Rail Planer Type Milling Machine, 4 heads, 1940
LaPOINTE HP 5 Ton Hor. hyd. broach—1947
MOREY #12M Vertical Shaper
NIAGARA Model H6 6' x 3/16" Power Squaring shear
P & W 4½ x 12 Model C Thread Miller
P & W 6 x 60 Model C Thread Miller
THOMPSON 12" x 18" x 60" Hydr. Surface Grinder

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NATCO Model B-225H Adj. power rapid traverse, rectangular head; M.D.; late

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PRATT & WHITNEY ½x50 Rifle; late type
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CINCINNATI BICKFORD 4' arm 13" col., "Super Service"; late type
CINCINNATI BICKFORD 5' arm 13" col., Late
CINCINNATI BICKFORD 6' arm 15" col., Univ.
CINCINNATI BICKFORD 6' arm 17" col.; Plain
MORRIS 3' arm 11" col., "Mor-Speed" Plain
MORRIS 4' arm 11" column "Mor-Speed"; late

GEAR EQUIPMENT—Fellows

FELLOWS No. 6 gear shaper; M.D. late
FELLOWS No.4T Thread Generator; 4"x18"; late
FELLOWS No. 6IA High Speed Gear Shaper; cap. 18"; late type
FELLOWS No. 6Z2 High Speed Gear Shaper; late
FELLOWS No. 612 High Speed Gear Shaper; late
FELLOWS No. 624A High Speed Gear Shaper; late
FELLOWS No. 645-A Gear Shaper; late type
FELLOWS type 645-A3 High Speed Gear Shaper
FELLOWS No. 7 High Speed Gear Shaper; late
FELLOWS No. 7A High Speed Gear Shaper; late
FELLOWS No. 72 High Speed Gear Shaper; late
FELLOWS No. 75 High Speed Gear Shaper; late
FELLOWS No. 715 High Speed Gear Shaper; late
FELLOWS No. 7125 High Speed Gear Shaper; late
FELLOWS No. 77 Gear Shaper; late type
FELLOWS No. 13LS Lapper; late type

GEAR EQUIPMENT—Gleason

GLEASON No. 1 Flame Hardener; late type
GLEASON 3" Spiral Gear Generator; late
GLEASON 3" Straight Bevel Gear Gen. late
GLEASON No. 4 Angular Hypoid Tester; M.D. late
GLEASON No. 6 Revacycle; late type
GLEASON No. 7 Hyp. Cutter Sharpener
GLEASON No. 12 Tool Sharpener; late
GLEASON 12" Straight Bevel Generator; for Roughing & Finishing; late type
GLEASON No. 12 Straight bevel gear Rougher; M.D.; late type
GLEASON No. 12B "Coniflex" Gear Generator; late type (SEE PHOTO)
GLEASON 12" Spiral Bev. Cutter Sharpener; M.D.
GLEASON 15" spiral bevel, cutter sharpener; M.D.
GLEASON No. 14 Spiral & Bevel Hypoid Gear Grinder; M.D.
GLEASON 15" Spiral Bevel Finisher; M.D.
GLEASON No. 15 Quenching Press; late
GLEASON 28" Quenching Press; late
GLEASON No. 18 Gear Tester & Lapper; M.D.
GLEASON 24" Bevel Gear Planer; M.D.
GLEASON 54" Straight Bevel Gear Planer M.D.

GRINDERS—Surface

ABRASIVE 1½ hand surface grinder; late
AGA 8"x24" Prec. Hydr. Grinder; late type
BILLITER & KLUNZ 48"x186" Way Grinder
BLANCHARD No. 18 Rotary; cap. 36" dia. M.D.
BROWN & SHARPE No. 2; motor drive; late
BROWN & SHARPE No. 2; NEW
HANCHETT 36"x120" Wheel Grinder; late
HEALD No. 22 Rotary; 12" chuck; M.D.
HEALD No. 25A Rotary; 36" Chuck; late
HEALD No. 26t Rotary Surface Grinder; 12" chuck; latest type (SEE PHOTO)
MATTISON 14"x60" Hydr. Surface Grinder; late
NORTON 6"x18" Vertical and Horizontal; late
PRATT & WHITNEY "B" 14"x36" Vert.; late
REID No. 48 hand feed; 4"x18"; late type

GRINDERS—Thread

EX-CELL-O No. 33 Thread Grinder; late
EX-CELL-O No. 35L 60" centers; late type
LANDIS No. 6 Precision; late type

LATHES—Turret

GISHOLT 1L Univ. Saddle type; Timken; late
GISHOLT 2L Univ. Timken; late type
GISHOLT No. 3 Univ. M.D.; late type
GISHOLT No. 5 pre-selector head; late
LIBBY 4H-12; 12" hole; M.D.; late type
MOREY No. 2 ram type, Timken; latest type
MOREY No. 4 Univ. ram type; latest type
POTTER & JOHNSTON No. 8DT Automatic Chucking & turning; late type
WARNER & SWASEY No. 1 Electric; late
WARNER & SWASEY No. 1A Universal; for chucking work
WARNER & SWASEY No. 2A Universal, for chucking; M.D.; late type
WARNER & SWASEY No. 4 Univ., preselector head; late type
WARNER & SWASEY No. 4-A; Univ. 9" hole; latest type

MILLING MACHINES

BROWN & SHARPE No. 2 "Light Type," PRT, Timken; late type
BROWN & SHARPE No. 12 electrically controlled; late type
CINCINNATI 2-24 Automatic; Timken; M.D.
CINCINNATI 2-24 Hydr. rise & fall; Timken late
CINCINNATI No. 4 High Power; Dial Type; High Speed; M.D.; New 1952
CINCINNATI No. 5-48 tracer controlled; Hydr.; late
KEARNEY & TRECKER (Milwaukee) No. 3K; Timken Bearing; late type
KENT OWENS; table 22"x5"; M.D.; late
ROCKFORD No. 3 "Rigidmil"; M.D.
STARR No. 2 Table 13"x55", late type
SUNDSTRAND No. 33 Plain; late type

MILLING MACHINES—Vertical

BRIDGEPORT ½ H.P.; table 9"x36"
BROWN & SHARPE No. 2 Light Type Vert.
CINCINNATI 0-8 Vertical, Timken; late
CINCINNATI No. 2M Vertical; late type
CINCINNATI No. 3; dial type; high speed or medium speed; Timken; late
KEARNEY & TRECKER "Milwaukee" Model 2KM Timken; latest type
KEARNEY & TRECKER "Milwaukee" Model 4H Timken; late
KEARNEY & TRECKER (Milwaukee) No. 4K high speed; Timken; power rapid traverse; M.D.; late
REED PRENTICE No. 5 PRT; Timken; late

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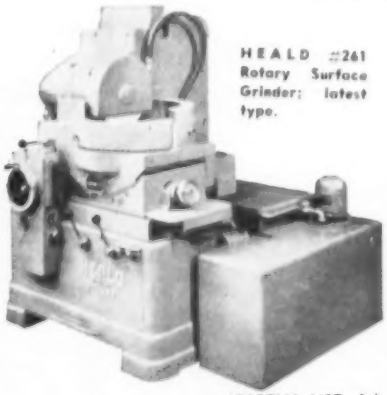

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NILES BEMENT POND 72"x72"x10'; 4 hds.; Power Rapid Traverse; D.C.; M.D.
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CLEVELAND 1-1/16" model A single spindle; late
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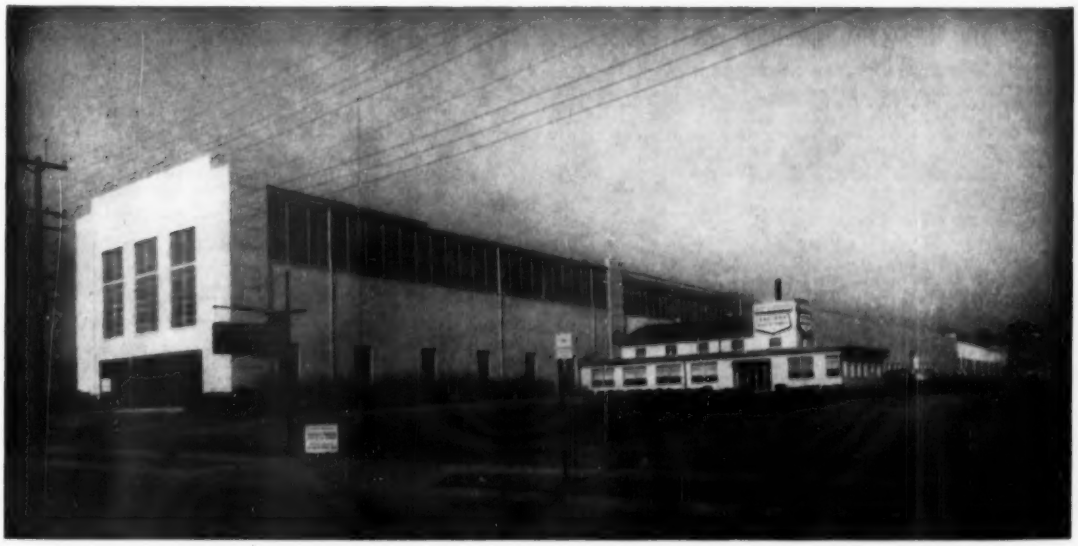
Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY



AUTOMATICS

½" Cleveland Model A, m.d., 1943
Model 1½B-18 Cleveland, single spindle, m.d.
Model B-1-1/16" Cleveland, m.d.
4 spindle 1⅝" Cleveland Model M, m.d.
4 spindle 2" Model K Cleveland, m.d.
2" Cleveland Model A, single spindle, m.d.
2½" Cleveland, m.d., Model A
No. 8A Cleveland, m.d., 8" cap., latest
14" Fay Flanders Type, m.d.
No. 4D Potter & Johnston, m.d.
No. 6C Potter & Johnston, m.d.
No. 5 DELX Potter & Johnston, m.d., late

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1½" Landis 2 spindle, older type
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 326 Oster Bolt & Pipe Threading Machine, m.d.

HORIZONTAL BORING MILLS

4" bar Lucas, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
8" bar Barrett No. 6 Horizontal Cylinder, m.d.
10" bar Sellers Floor Type, m.d.
No. 25T Giddings & Lewis, m.d., late
Barrett Double End, 7" and 5" spindle, m.d.
Floor Plates—all sizes

VERTICAL BORING MILLS

16" Bullard Mult-Au-Matic, m.d.
24" Bullard Spiral Drive, 1943
36" Bullard H.S. Spiral Drive, 1942
42" Bullard New Era, m.d.
42" King, direct m.d., thru gear box
42" King with side head and plain swivel head on rail, 1940
44" Putnam, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
100" Niles Heavy, m.d., p.r.t.
102" Niles Wheel Turning Boring Mill

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke LaPointe Single Ram Vertical Surface Broach, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Gilgear Hydraulic Broach, type XA, 54" stroke, m.d.

RADIAL DRILLS

5'-14" column Fosdick, m.d.
5'-14" col. Cariton, m.d.
7'-16" col. American Triple Purpose, m.d.
8'-17" col. American Triple Purpose
8'-17" col. Drosco, gear box m.d.
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 4 Fosdick, 8" overhang, High Speed, m.d.
No. 15 Buffalo Floor Model, m.d.
No. ½, 1, & 2 Avey, belted m.d.
No. 4B Edlund, m.d., new
1 spindle No. 2MA6 Avey High Speed, m.d., 7" overhang, 1943
2 spindle Allen, belted m.d., 8" overhang
No. 2LMS Leland-Gifford, single spindle, High Speed, m.d.
No. 2LMS Leland-Gifford, H.S. Hydraulic Feed, m.d.
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, style VHP m.d., 8" overhang
2 spindle No. 3MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland-Gifford High Speed, 8" overhang, m.d.
3 spindle No. 2MA6 Avey High Speed, m.d.
3 spindle Leland & Gifford #1 LMS—High Speed, late, m.d.
3 spindle Leland & Gifford High Speed, m.d.
4 spindle Leland & Gifford, m.d. on each spindle
6 spindle Leland & Gifford, m.d. on each spindle, No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.

HORIZONTAL DRILLS

3 way Natco Horizontal Drill, consisting of 3 E13 Hole units
No. ½B-50" Pratt & Whitney Gun Barrel Rifling Machine, m.d., latest
No. 1Bx74" Pratt & Whitney 2 spindle deep hole Reaming Machine, m.d.
No. 1½x105" Pratt & Whitney 2 spindle Gun Barrel Rifling Machine, m.d.
No. 1 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Model 410 W.F. & John Barnes, 2 spindle Hydraulic Deep Hole Drill, m.d.
Pratt & Whitney Deep Hole Drill Sharpener, m.d.
Natco Horizontal Drill, holesteel model, m.d., 1942
Natco Horizontal Drill, 2 opposed B4F2 Heads, 1943

MULTIPLE SPINDLE DRILLS

24" Barnes All Geared Self-Oiling, 3 spindles, m.d.
No. 3 Baush, m.d., 18x30" head
4 spindle Niles-Bement-Pond, m.d., 12' rail, No. 5 Taper
3 spindle 28" Cincinnati-Bickford Upright Drill, m.d., No. 4 M.T.
No. 924 Barnes Vertical Drilling, Boring, Facing & Reaming Machine
6 spindle W.F. & John Barnes Vertical Drilling Machine, m.d.
3 spindle Rockford 12" Gang Drill, m.d.

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HORIZONTAL BORING MILLS

No. 43 LUCAS Horizontal Boring, Drilling & Milling Machine, 5" bar

VERTICAL BORING MILLS

24" Spiral Drive BULLARD Vertical Turret Lathe
24" High Column Spiral Drive BULLARD Vertical Turret Lathe
6' CINCINNATI Vertical Boring Mill (AC Motor Drive)

DRILLS

6'17" AMERICAN Triple Purpose Radial Drill (older)
8' 19" CINCINNATI BICKFORD Super Service Radial Drill (rebuilt and ready)

GEAR CUTTERS AND HOBBERS

No. 61 FELLOWS Gear Shaper (older)
No. 61A FELLOWS Gear Shaper (late)
No. 135 CLEVELAND AXLE Shaft Hobber
No. 36 BM GOULD & EBERHARDT 3-Spindle Bevel Gear Cutter
No. 36B GOULD & EBERHARDT Automatic Gear Cutter (late)
No. 725 FELLOWS High Speed Gear Shaper
No. 12 GLEASON Straight Bevel Gear Rougher
No. 60SM Gould & Eberhardt 3-Spindle Vertical Gear Cutter (nearly new)
Model A BARBER COLMAN Hobber

GRINDERS

No. 2 CINCINNATI Centerless Grinder—plain bearing
No. 5 BRYANT Internal Hydraulic Hole Grinder (late)
No. 16-16 BRYANT Hydraulic Internal Hole Grinder (late)
No. 16-38 BRYANT Internal Hydraulic Hole Grinder (late)
No. 24 P 26 BRYANT Hydraulic Internal Hole Grinder (late)
No. 50 HEALD Internal Grinder (late)
6" x 18" CINCINNATI Plain Cylindrical Grinder Type EA, saddle (rebuilt and ready)
10"x18" NORTON Semi-automatic Plain Cylindrical Grinder (late)
10" x 48" LANDIS Plain Cylindrical Type C Grinder (late)
14" x 168" LANDIS Type CH Plain Cylindrical Grinder (late)
14" x 72" Plain CINCINNATI Self-contained Grinder
16" x 36" NORTON Type C Cylindrical Grinder (late)
Model A3-16 ARTER Rotary Surface Grinder
Model 25A HEALD Rotary Surface Grinder (rebuilt and ready)
No. 16A2 BLANCHARD Automatic Surface Grinder (excellent)
Model 76 RAP ROGERS Knife Grinder

MILLERS

No. 2 BROWN & SHARPE Lite Type Hi-Speed
No. 4F K & T Plain Mill Motor-in-base. Timken Spindle
No. 4 Dial Type Plain Mill Medium Speed
No. 2A BROWN & SHARPE Universal Horizontal Mill (older but good)
No. 4 CINCINNATI Hi-Power Vertical Mill Timken Spindle (late)
No. 4-48 CINCINNATI Hydro-matic Duplex Mill

PLANERS

36" x 36" x 26' CINCINNATI Double Housing Hypro Planer (reversing motor drive)
48" x 48" x 10' GRAY Double Housing Planer (reversing motor drive)

TURRET LATHES

No. 5 GISHOLT Ram Type Turret Lathe Hydraulic Pre-selector (late)
No. 1 CINCINNATI ACME Heavy Duty Turret Lathe (good)
No. 1A WARNER & SWASEY Geared Head Way Type Turret Lathe (older type)
No. 2A WARNER & SWASEY Geared Head Way Type Turret Lathe (older)
No. 2A WARNER & SWASEY Geared Head Way Type serial 900,000 (1946)
No. 2L GISHOLT Geared Head Way Type Turret Lathe, hydraulic pre-selector
No. 5D POTTER & JOHNSTON Geared Head Way Type Turret Lathe (late)

MISCELLANEOUS

14" x 16" COULTER Automatic Screw Cutting Lathe (late type)
12" 8-Spindle BULLARD Mult-Au-Matic
6" x 60" MODEL C PRATT & WHITNEY Thread Mill (rebuilt and ready)
No. 22 MURCHEY Single Head Threader (practically new)
No. 3A High Speed Heavy Duty Riveting Hammer
6" RHODES Shaper (good)
28" AMERICAN Plain Industrial Shaper (older)
18" DILL Universal Slotter (late)
NORTON Bura-way Precision Form Grinder
30-ton LUCAS Forcing Press

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16" x 120" LANDIS Cyl. Grinder—1943
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8"x18" CINC. Vert. Mill & Die Sinker, Complete '53
#4D & 5D POTTER & JOHNSTON Turret Lathe '43
P&W Miller & Die Sinker, 18"x72" Table
#D1 BECKER MILLER & Die Sinker, 20"x110" Table

PLANERS: 120"x60"x22' D&H Openside, 72"x60"x24' D&H Openside Hvy Dty. Worm Drive, 3 Motor Drive, Rapid Traverse Box Tble—Pendant Control.
2—62"x62"x20' NILES Heavy Duty
28"Cinc. 2 Spdl. hydratel profiler 1942

12' #3 H&J Pyramid Roll, Drop End 2 Motor Drive
13' SOUTHWARK Initial Roll, Open End
10'-½" Cap. Cinc. Brake—1952

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#45—5" Giddings & Lewis Horizontal Table Type Boring Mill Serial #8046
#5 Cincinnati Plain Milling Machine Serial B19 H
48" x 48" x 12' Cleveland Heavy Duty Openside Planer
42" x 42" x 12' Cleveland Heavy Duty Openside Planer Serial 3452
Late Type No. 120—50" x 120" Hanchett Horizontal Spindle Plane Surface Grinder Serial 08-13.

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Bliss-Toledo No. 93½H, cap. 140 tons, Bed 84"x48"
Bliss No. 5-40 Double Action Toggle Draw Press, Strokes 20" and 31", Will draw and lift out 15", Bed 40"x40"

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BORING MILLS 4½" bar Sellers, Floor Type
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4" & 3½" Bar Landis, Floor Type (2)
3" Bar Universal Tble. Type, Triway
GRINDERS, 60" Hanchett Vert. Spin., No. 300 Hyd., Surf.
Nos. 2B Reid, 3B Abrasive, Surf.
36"x42" Pratt & Whitney Die & Surf.
30"x120" Hanchett Plano. Surf.
16"x96" Cinci. Plain Cyl.
LATHES, 25"x192" Cen. Lehmann, T.A.
18"x48" cen. Monarch, '42
20"x54" cen. Reed Prentice '43
TURRETS No. 2H10 Libby 10¼", '43
Nos. 5 & 3 B. & O. '43
No. 3 Gisholt, Bar Chuck, '42
ROLLS, 10"x¾" Bertsch Pinch '43
SHAPER, VERT., 12" Pratt & Whitney, 1942
SLOTTER, 30" Rockford, Hyd. '44

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LATHES

24" x 12' BOYE & EMMES Grd. Head, Timken Bearing, Taper Attachment.

4 DE POTTER & JOHNSTON Automatic Turret Lathe. Late Type.

27" x 18' MONARCH "N" Geared Head Lathe, 11' Centers, Taper Attachment, Full Equipment. Late Type. 1942.

24" x 36" BULLARD Vertical Turret Lathe, Turret Hd., Side Hd., M.D.

No. 2, 4, 6 WARNER & SWASEY Univ. Turret Lathes, Bar Feed.

No. 2, 7 BARDONS & OLIVER Universal Turret Lathes, Preselector, Bar & Chucking. Late Type.

DRILLING MACHINES

36" CINCINNATI BICKFORD Upright Drill Press, P.F., M.D.

3', 4', 5', 6' CINCINNATI BICKFORD Radial Drills.

6 Spindle No. 2 LMS Leland-Gifford Drill Press. Late Type.

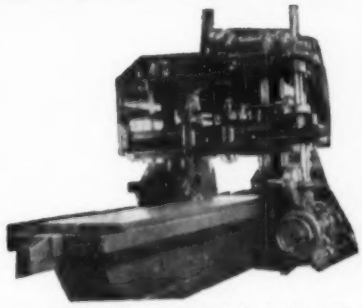
No. 2 M. T. Six Spindle ALLEN Type KH Drill Press, Individual Motor Drive. Late Type.

MILLS

#2B KEARNEY & TRECKER Univ. Horizontal Vertical Head. M. D.

No. 2 BROWN & SHARPE Vert. Mill, Light Type, Swivel Head, M.D. Late.

1A PRATT & WHITNEY Jig Borer, with Gauges, Rods, Collets and Chuck.



No. 2B BROWN & SHARPE Horizontal Mill, Motor in Base. Late Type.

42" by 36" x 12" INGERSOLL Planer Type Mill, two heads on rail, two side heads, M.D.

PRESSES

No. 6 BLISS Straight Side Press Double Crank 135 Tons Cap., Motor Driven.

No. 8 BLISS CONSOLIDATED 90 Ton Cap., O.B.I. Geared. Air Cushion. M.D.

400 Tons CHAMBERSBURG Hydraulic Wheel Press, 14" Ram, 96" between Tie Bars, 12' to End Support. M.D.

GRINDERS

No. 2 CINCINNATI Universal Tool & Cutter Grinder. Motor Driven.

4" x 12" LANDIS Hydraulic Plain Cylindrical Grinder, M.D. Late Type.

6" x 18" NORTON Hydraulic Horizontal Surface Grinder, Permanent Magnetic Chuck, Coolant System, Late Type.

No. 14 W HAMMOND Double End Carbide Grinder, M.D.

6" x 10" x 48" NORTON Hyd. Horiz. Surf. Grinder, M.D.

4T SELLERS Tool Grinder, M.D. Late Type.

30" INGERSOLL Face Mill Cutter Grinder, M.D. Late Type

6" x 18" LANDIS Type "C" M.D. Hyd., Cylindrical Grinder, Serial #29196.

No. 208 BESLEY Motor Driven Disc Grinder, 26" Wheels. Late Type.

MISCELLANEOUS

18 KW SCIENTIFIC ELECTRIC Induction Heater, Tube Type.

6' x 14 ga. WYSONG & MILES Shear

No. 8LS FELLOWS M.D. Gear Lapping Machine, Detachable Head, Univ. Work Support.

No. 1, 2, BUFFALO FORGE Vertical Angle Bending Rolls, M.D.

½, 1½ BUFFALO FORGE Universal Ironworker, Notcher and Coper, M.D.

No. 00G BROWN & SHARPE High Speed Automatic Screw Machine, M.D. Late Type.

No. 6 BROWN & SHARPE Automatic Screw Machine, M.D., 2" Capacity.

10' x ¼" WYSONG & MILES Power Squaring Shears, Motor Driven.

No. 194 BARNES Vertical Hone, 4" Capacity, 12" Stroke, M.D.

12" PRATT & WHITNEY Vertical Shaper, Keller Attachment. Late Type.

12" ROCKFORD Hydraulic Vertical Shaper. 1953.

15' x 10' x 36' BETTS Double Housing Planer, 4 Swivel Heads, Pendant Control, Box Table, Motor Driven.

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Bridgeport Vert. Miller with Shaping Attach.
Brown & Sharpe No. 2 Surf. Grinder All Motorized
G&L 3" Bar Table Type Horiz. Boring Mill
Colburn 2-Spindle Box Col. Heavy Drill M.D. 20"
Niles (Timesaver Model) 32"x14' Bed Grd. Hd. M.D. Lathe 7' Centers.
Niagara 4' Power Shear ¼" Cap. 20" Gap
Ohio 24" M.D. All Grd. Feeds Shaper 1942 model
Cincinnati No. 5 Rect. Overarm Grd. Hd. Plain Horiz. Miller.
Baush 44" Vert. Boring Mill 2 heads.
American Vert. Hyd. Broach 48" str. 15 ton cap. 1947
American 20"x8" Grd. Hd. Lathe motor in base.
Landis 20"x72" and 18"x96" Plain st. Grinder.
Hanchett 25 H.P. Sp. Vert. Hydr. Surf. Grinder 12"x48" table
W&S No. 2-A Grd. Hd. Univ. Turret Lathe
Bliss 200 T Cap. S.S.S.C.B. Grd. Press 6" Str. #77
Rivett No. 104 A.C. M.D. Internal Grinder.
Milwaukee Nos. 2-B & 5-B Horiz. Plain Millers
DoAll 18" Job Selector Metal Saw.
Cincinnati 36"x36"x10' D.H. Planer 2 Hds. Box
Baker 314-A Box Col. Drill #5 Taper Late
Heald No. 72A-3 Hydr. Int. Grinder Rod Head Sp.
American 28"x27' Bed Grd. Hd. Lathe 20' Centers
Cleveland 30"x8' Table Open Side Planer 2 Hds.
Cincinnati No. 2 HI-Power S.P.D. Vert. Miller.
B&S #2A Grd. Hd. Horiz. Univ. Miller.
Barnes 20" All Grd. Camel Back Drill 1-Sp.
Blanchard M.D. Vert. Sp. Surf. Grinder 26" chuck.
Sundstrand 4-Sp. Vert. Rigidmill.
Heald #22 Ret. Surf. Grinder 12" chuck 1942.
Landis 2-Sp. 2" Cap. Bolt Threader M.D.
Hendey 16"x8' bed Q.C.G. Lathe 1939.
G & E 24" Gear Box Shaper Tilt. Table Top.
Newton 48" Table 1-Sp. Cont. Vert. Miller.
Foster 2-F Fastermatic Hyd. Turret Lathe.
Kempsmith No. 2 Vertical Maximiller M.D.
P & J #2 Auto. Prod. Miller, 2 Tables.
Cincinnati #2, #3 & #4 Centerless Grinders, all Motor Driven
Bullard 24" Vert. Turret Lathe.
Lynd-Farquhar 26" stroke open-side Shaper Planer.

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●SBD 72-30 American Duplex Vertical Broach 30-ton 72" stroke. 1943.

●36" x 240" Centers Niles Timesaver Engine Lathe. New in 1941.

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LATE TYPE MACHINE TOOLS

FOR SALE

#4 Cincinnati Centerless Grinder #3M4H1K (Filmatic)
#35L Excello Thread Grinder #1383
#39A Excello Internal and External Thread Grinder #9185
#55 Heald Horizontal Grinder #15429
Sundstrand Plain Duplex Milling Machine, Model #33FM18120, Ser. #96-265 (10 ft. table).
#5A Bryant Internal Grinder #K8732
2—918 Rivett Bench Lathes, #764 and #1027 (steel cabinets).
9" Elgin Bench Lathe #EB5C-3877 (steel cabinet).

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Announcing the consolidation of our plant and sales office at 2100 South Kilbourn Avenue (4500 west), Chicago 23, Illinois, on September 1, 1956 (phone until August 26, Central 6-0500, and after August 26, Crawford 7-2000.)

PARTIAL LISTING

BORING MACHINES

Foote Burt Vert. 26" sw. new 1941
#40 Heald Borematic, new 1944

DRILLS

1 spdl. 14" sw. #7 Avey, new 1945
1 spdl. 20" sw. #2LM8 L. G., 1945
1 spdl. 24" sw. #2MA6 Avey, new 1942
1 spdl. 26" sw. #1M8 L. G. hydraulic
2 spdl. 24" sw. #3 Avey, AC MD.
3 spdl. 20" sw. #2LM8 L. G. 1942
3 spdl. 24" sw. #3M8 L. G., new 1943
4 spdl. 14" sw. #2LM8 L. G. new 1942
6 spdl. 20" sw. #1LM8 L. G. new 1943
#311-A Baker Univ. H.D., 1942
16 spdl. Fox #K69H, #2 taper, 1944

BORING MACHINES

Foote Burt Vert. 26" sw. new 1941
#40 Heald Borematic, new 1941

GRINDERS

2"x12" #5 B&S, Rap. Trav., 1948
3"x18" #5 B&S, Rap. Trav. 1943
4"x12" #4H Landis, 1942
4"x18" No. 4H Landis 1943
6"x18" Norton Type C, new 1943
10"x18" Norton Type C, new 1943
10"x36" Norton Type C, new 1942
10"x48" Norton Type C, new 1942
10"x50" Hill-Clarke, AC Mot. Dr.
10"x72" Hill-Clarke, AC Mot. Dr.
10"x96" Hill-Clarke, AC Mot. Dr.
10"-20"x36" Norton, angular wheel
16"x72" Hill-Clarke, AC Mot. Dr.
16"x120"x72" Norton, AC MD, 1941
42"x72" Norton, extras, new 1947
18"x96" Hill-Clarke, AC Mot. Dr.
18"x120" Norton, AC MD.
24"x264" Norton, AC MD, Rebuilt
26"-32" Gap x 114" Norton Pl. Cyl.
#5A Bryant Internal, new 1943
#16A-16 Bryant Internal, new 1943
#16-38 Bryant Internal, new 1941
#24-26 Bryant Internal, new 1941
#24-36 Bryant Internal, new 1941
#72A3 Heald Int. Blematic, 1944
#72A5 Heald Internal, new 1942
#72A5 Heald Bridge Type Int.
#214 Besly Double End Disc, 1940
#3-B Abrasive Surf, 8"x24" Table 1941
#18-50" Blanchard Rot. Surf.

LATHES

16ML, 16"x36" LeBlond Auto.
#16ML-16 LeBlond, Semi-Auto, 36" cc
12"x30" Hendey Lathe, Taper Att.
12"x28" Lipe Carbo Semi-Auto
14"x36" Amer. Grd. Bd., MD
22"x84" Amer. Grd. Bd., MD
24"x42" Fay Auto. AC MD
60"x126" Putnam Grd. Bd., MD
#14 Seneca Falls, 16"x36", 1942
120"x96" or N.B.P. ser. 3380
#5W Cinc Acme Univ. Turret
#4 Gisholt Univ. Tur. A.C.&B.F.
#3H-16 Libby H.D. Tur. 1942
#4A W&S Turret, new 1944
4FU Fastermatic, tur. 33" sw, 1944
#8D Potter & Johnston, new 1941

MILLERS

54"x30"x16 Ingersoll Slab, 1934
54"x8' Ingersoll Openside, 1942
54" Ingersoll Vertical Rot.
#M-24 R&T Prod. 1941
#6V Davis & Thompson Vert., 1944
3½" Bar Cinc. Gilbert Table Type HBM
#12-B Pratt & Whitney Profilers
16"x60" P&W Mod. B Thread Mill
#LT 6"x72" L B Thread
3CT L-B Thread Mill new 1942
No. 2 Cinc. Univ. Hi-Power
#36 Van Norman, Rebuilt, 1941
#1-18 Van Norman Prod. 1942

PLANERS

36"x36"x12" Rockford Openside '42
60"x48"x27" American, 4 hds.
60"x48"x30" Hamilton, 4 heads

MISCELLANEOUS

6" Gore & DeLeeuw 8 spdls. 1941
#306 Barnes Vert. Hone, new 1942
15 Ton Hyd American Press, 1946
#11BD 2 Hd. W&S Tapper, latest
#36BM G&S 3 Spdl. Bevel Gear
#61A Fellows Gr Shaper 18" cam
#5A Kaufman Pneu Tapper, 1945
#HB8 Barber-Colman Sharp Mach
15 T Toledo Overhead Crane, 39½

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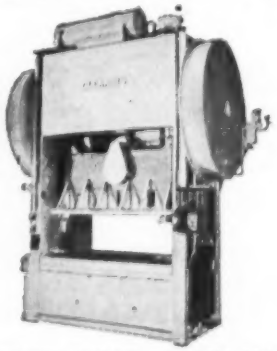

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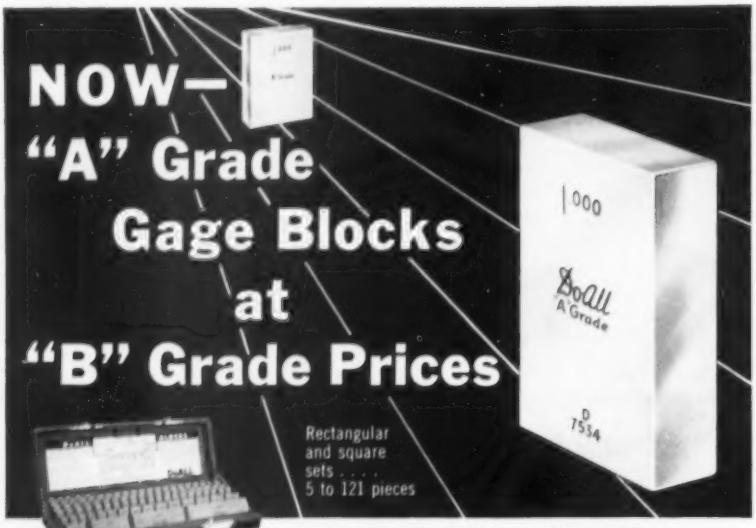

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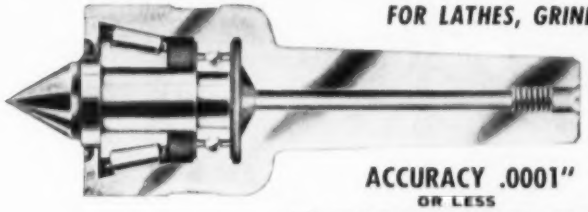

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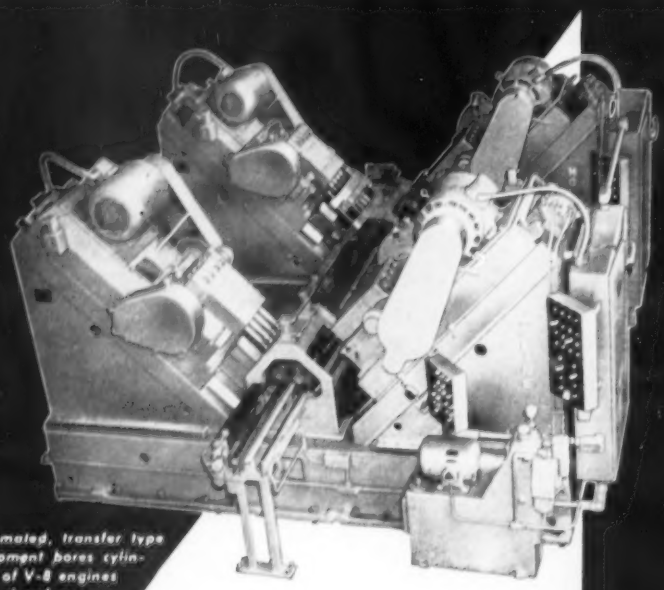

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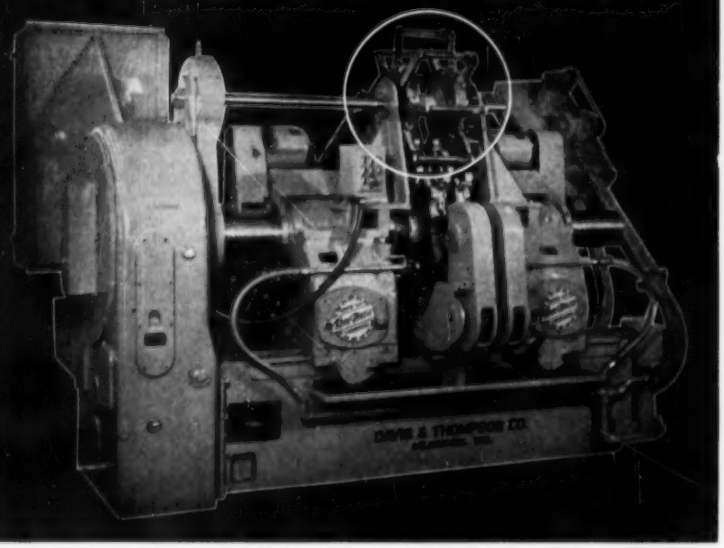

This continuous type milling and centering machine has been furnished with an automatic unloader (indicated by circle) which transfers finished parts onto a conveyor or discharge chute. Milling and centering of both ends is done simultaneously and in continuous production.

Basically, this is a standard ROTO-MATIC machine tooled-up to handle special production requirements. Rough and finish milling and centering spindles in both heads have micrometer endwise adjustment. Heads are adjustable on the ways. With equalizing jaws in fixtures plus chain clamping, machine is fully automatic.

If you have work of this nature, consult D&T engineering for further details.

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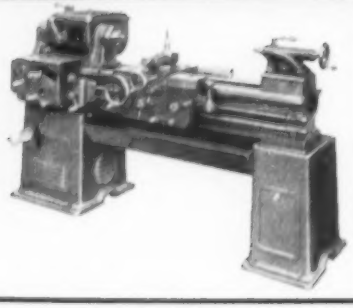

Standard taper key drive spindle nose. Heavy duty precision Timken taper bearings on spindle. Infinitely variable spindle speeds from 30 to 1500 rpm.

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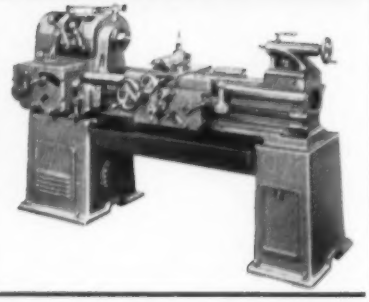

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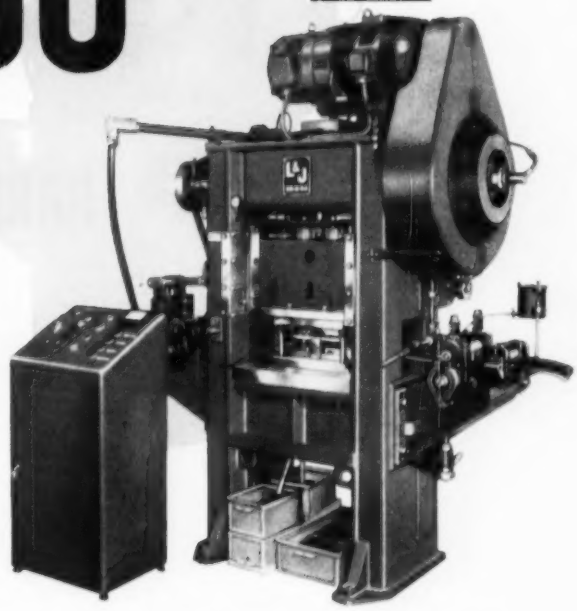

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Ram area	24" x 12"	24" x 12"	36" x 20"	36" x 20"
Bolster plate	24" x 19"	24" x 19"	36" x 24"	36" x 24"
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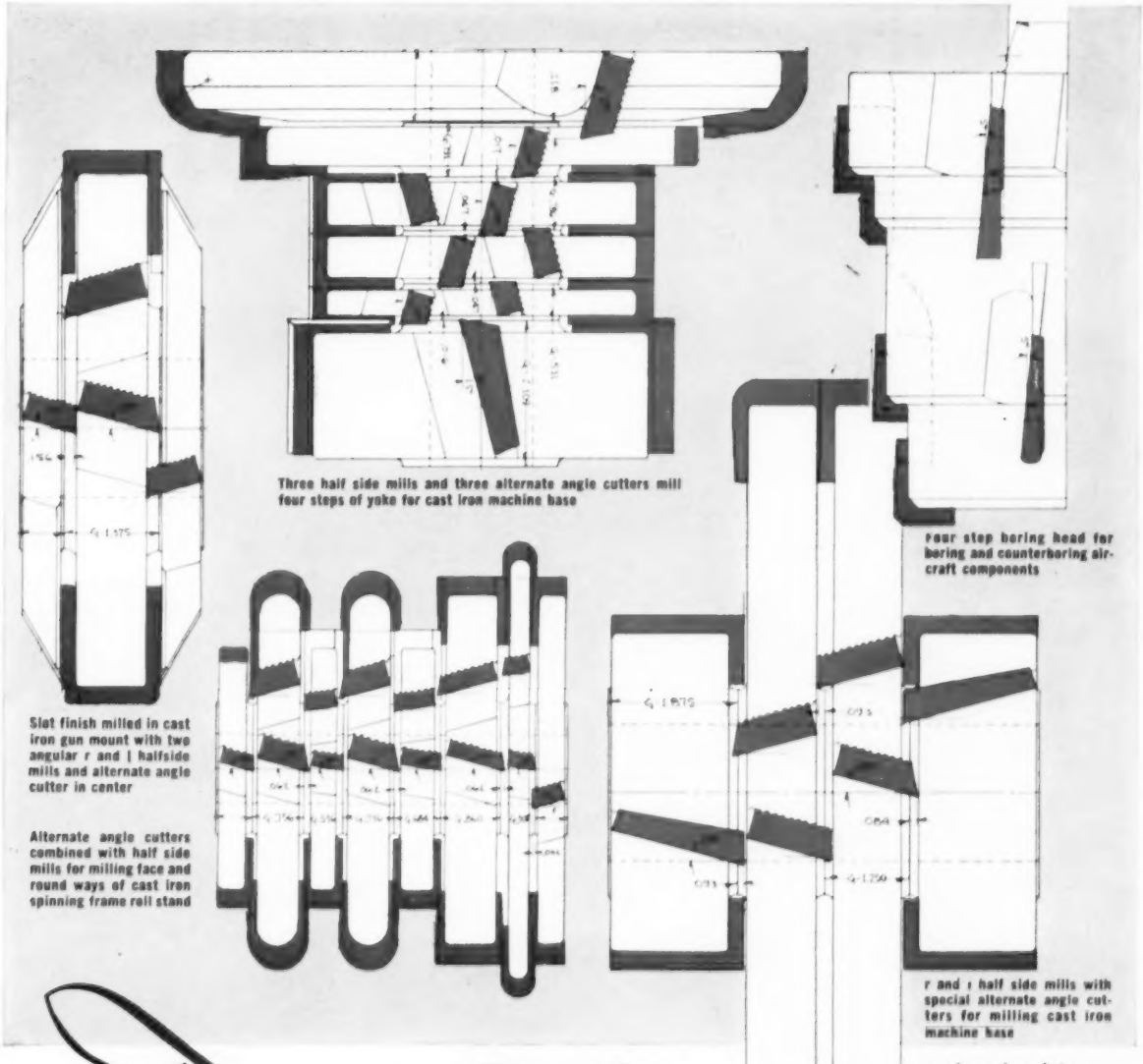

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